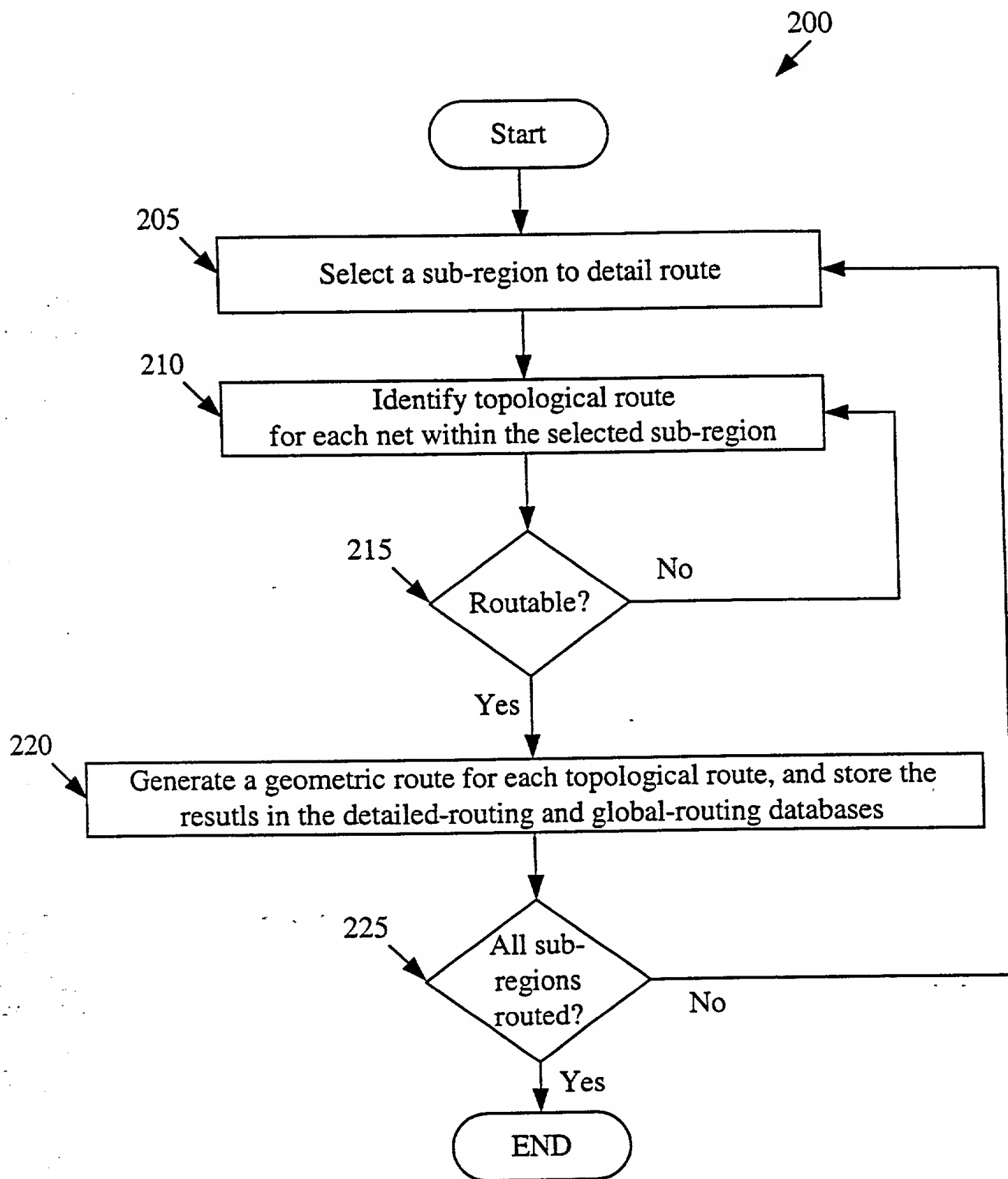


*Figure 1*



**Figure 2**



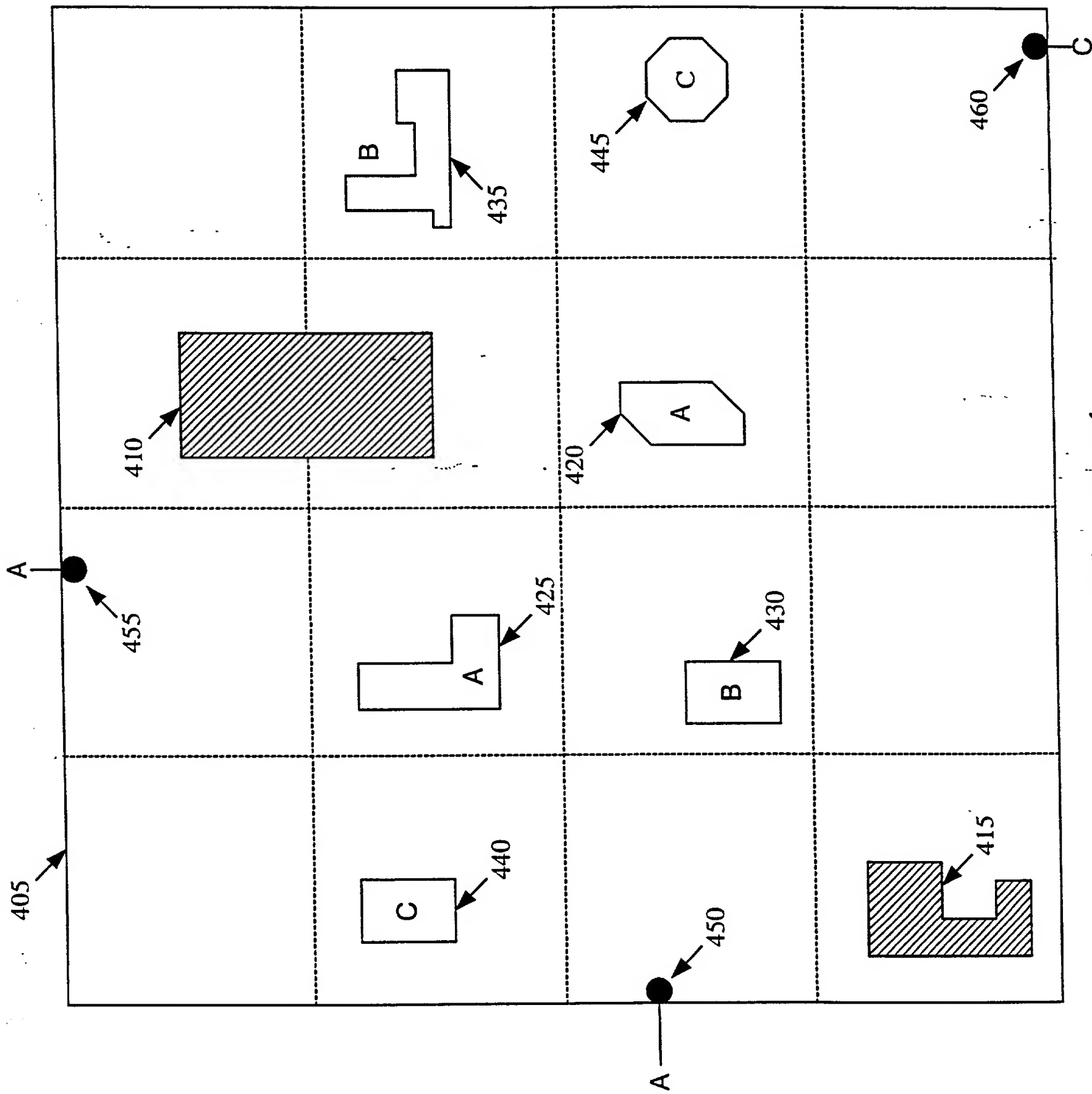
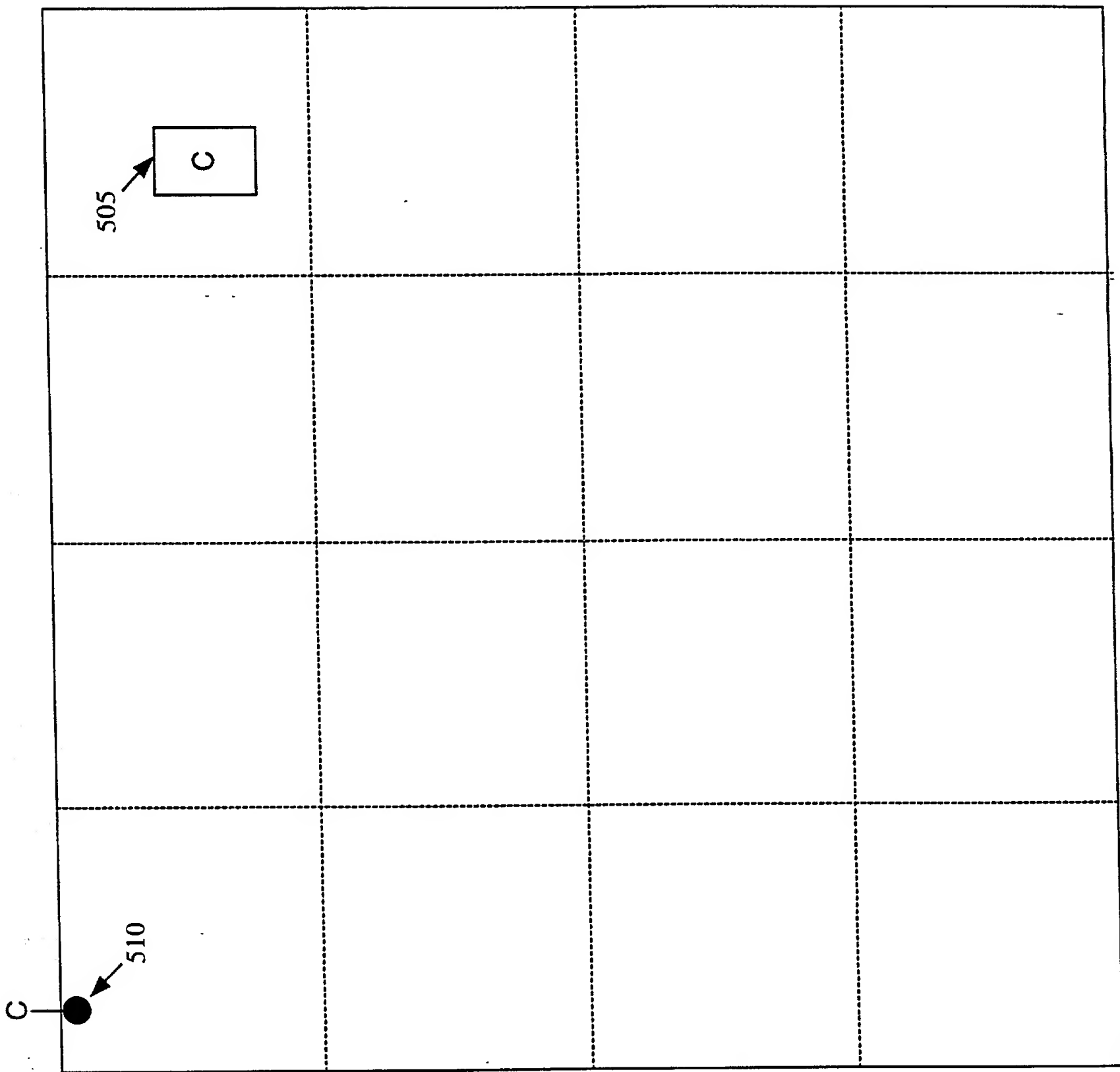


Figure 4



*Figure 5*

```

-List of Geometries
  --Each Geometry including a sequence of points & layer assignment
-Bounding box of the region
-Array of layer properties
  --Minimum wire size
  --Minimum spacing
  --Via sizes
  --Cost/Unit
-Netlist specifying a number of nets
  --Each net specifying a set of pins
    --Each pin specifying a set of ports
    --Each port specifying a set of geometries

```

*Figure 6*

```

-List of Geometries
  --Each Geometry including a sequence of points & layer assignment
    --List of connection nodes inside each pin geometry
-Bounding box of the region
-Array of layer properties
  --Minimum wire size
  --Minimum spacing
  --Via sizes
  --Cost/Unit
-Netlist specifying a number of nets
  --Each net specifying a set of pins
    --Each pin specifying a set of ports
    --Each port specifying a set of geometries
-For each layer, a graph specifying
  --Nodes
  --Edges
  --Faces

```

*Figure 7*

Face
<ul style="list-style-type: none"> <li>-Reference to 3 edges</li> <li>-Reference to 3 nodes</li> <li>-Up to two references for up to two face item</li> </ul>

800

Edge
<ul style="list-style-type: none"> <li>-Two references for up to two faces of the edge</li> <li>-Capacity</li> <li>-Flow</li> <li>-Constrained</li> <li>-Linked list of items on the edge starting with one of the edge's nodes and ending with its other node</li> </ul>

900

Figure 8

Figure 9

Node
<ul style="list-style-type: none"> <li>-Net Identifier</li> <li>-One or more planar-path references to adjacent topological items in the same planar path</li> <li>-A pair of via-path references to up and down topological via items</li> <li>-A references to list of edges connected to the node</li> <li>-For each edge, an edge reference to the next or previous topological item on the edge</li> <li>-A reference to the geometry of the node</li> <li>-Vertex number identifying the vertex of the geometry</li> <li>-Location of the node</li> </ul>

1000

*Figure 10*

Edge Item
<ul style="list-style-type: none"> <li>-Reference to its edge</li> <li>-Net Identifier</li> <li>-A pair of planar-path references to adjacent topological items in the same planar path</li> <li>-A pair of edge references to the next and previous topological item on the edge</li> </ul>

1100

*Figure 11*

Face Item
<ul style="list-style-type: none"> <li>-Reference to its face</li> <li>-Net Identifier</li> <li>-Up to 3 planar-path references for adjacent topological items in the same planar path</li> <li>-A pair of via-path references for up and down topological via items</li> <li>-Bounding polygon that defines legal face item locations</li> <li>-Constraining Points and Distances</li> </ul>

1200

*Figure 12*



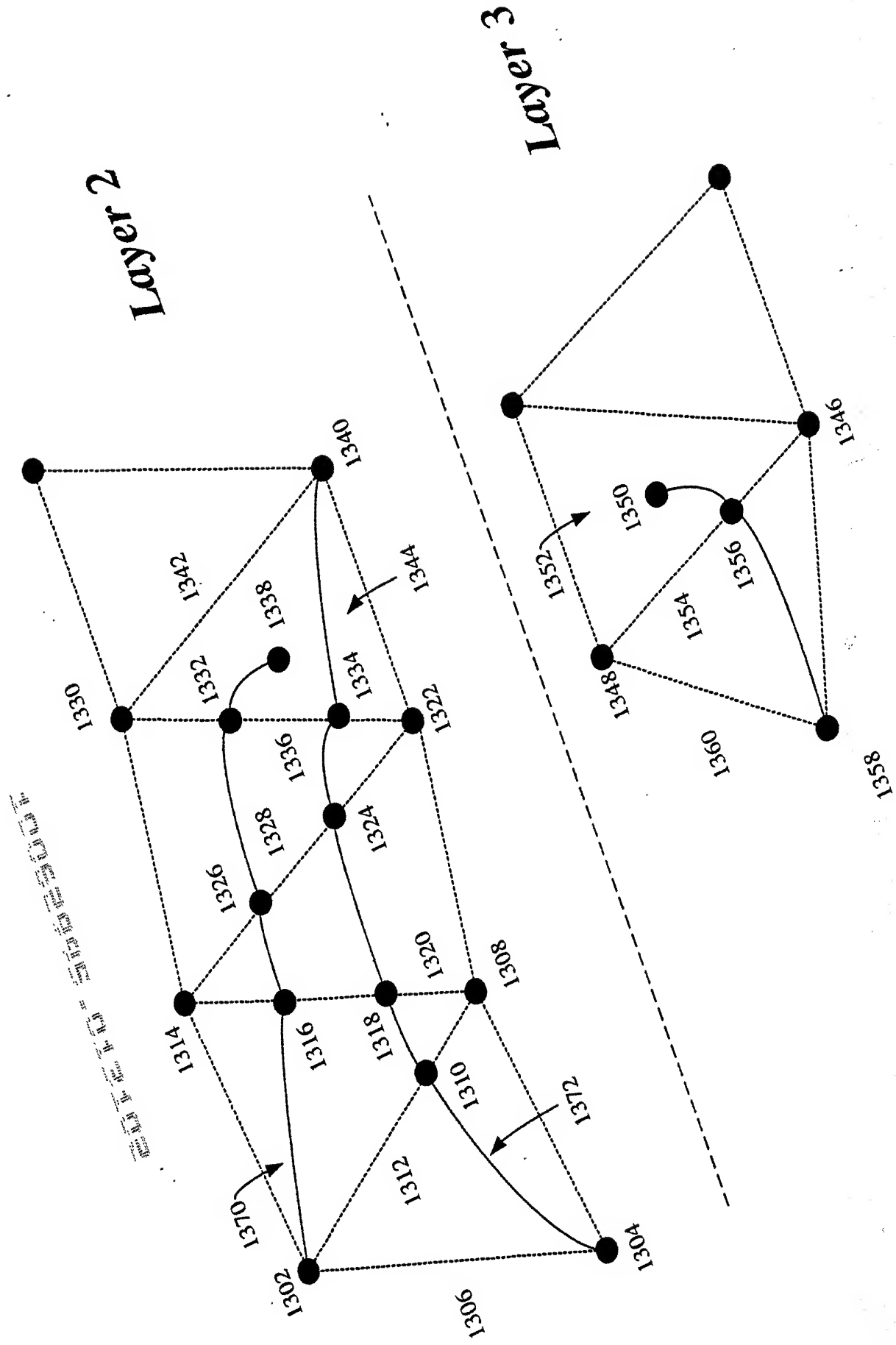
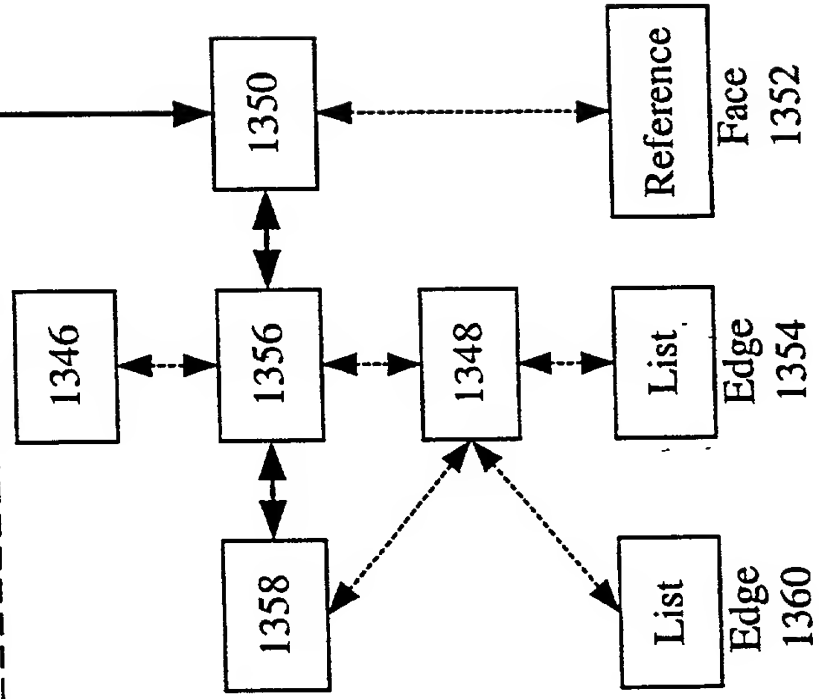
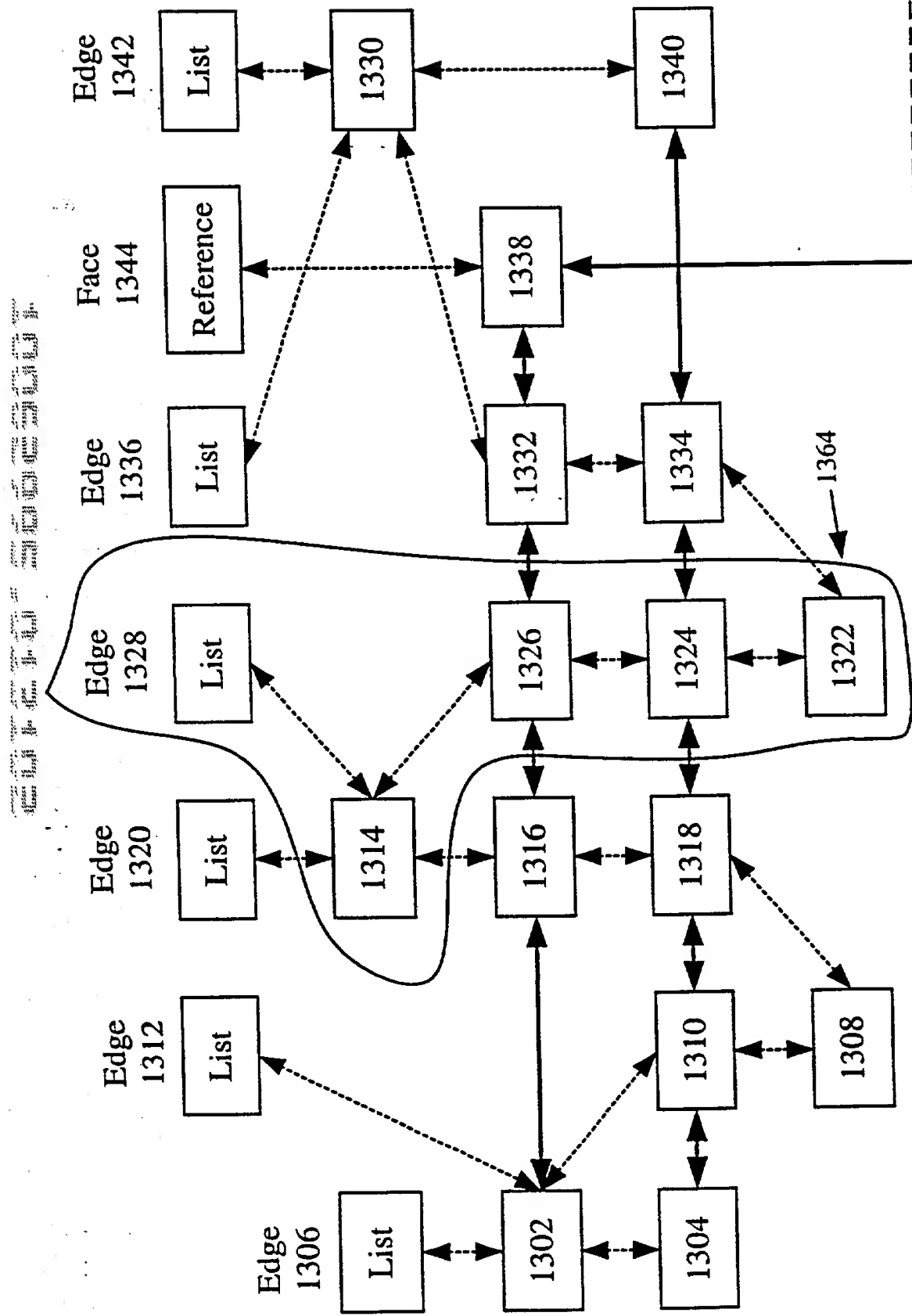
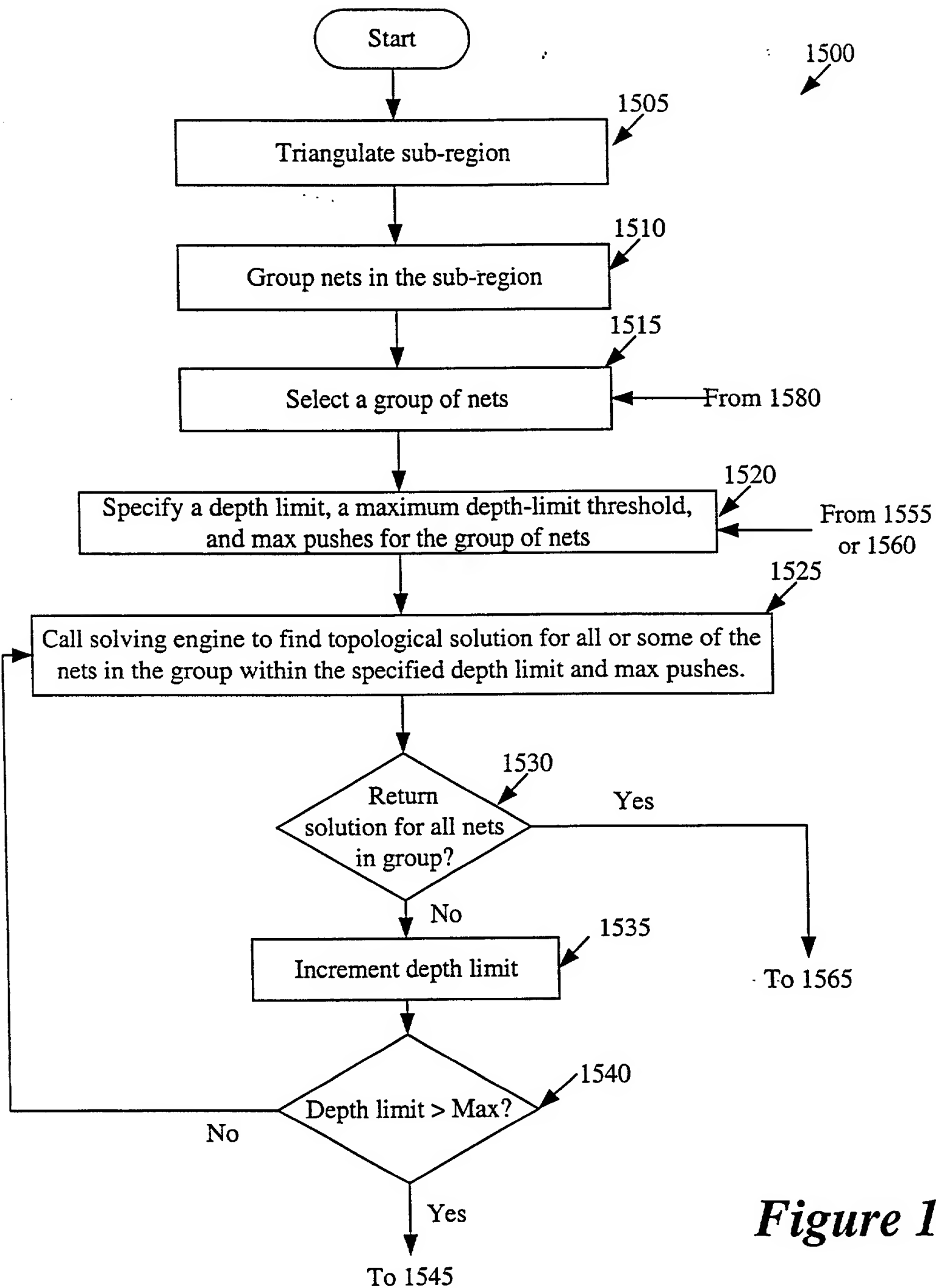


Figure 13

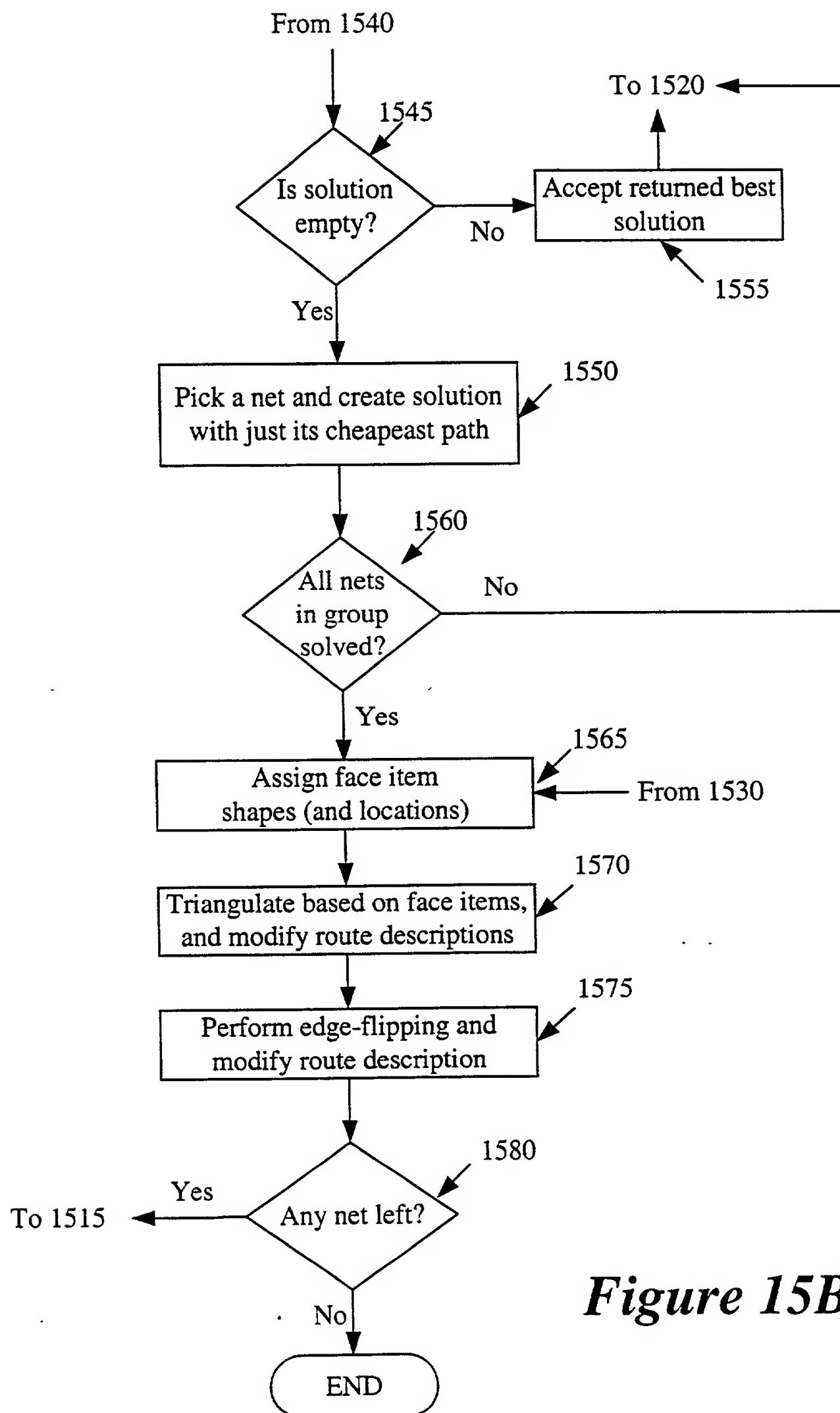


**Figure 14**

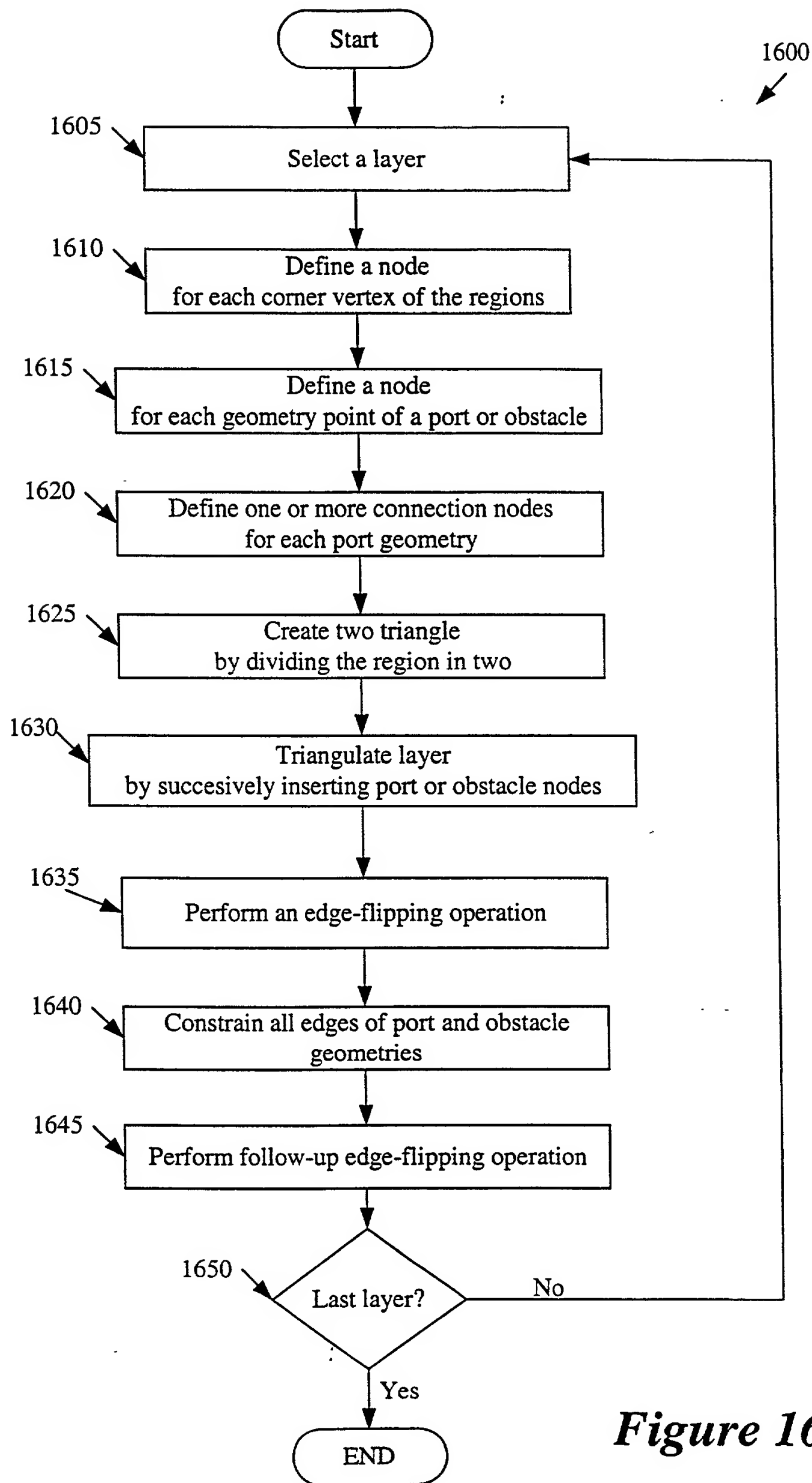


**Figure 15A**

**Figure 15:** *Figure 15A*  
*Figure 15B*



**Figure 15B**



**Figure 16**

Figure 17 is a diagram illustrating a 4x4 grid of squares. The grid is defined by solid lines, and the squares are separated by dashed lines. The grid contains various geometric shapes and points, labeled A, B, and C. The shapes are as follows:

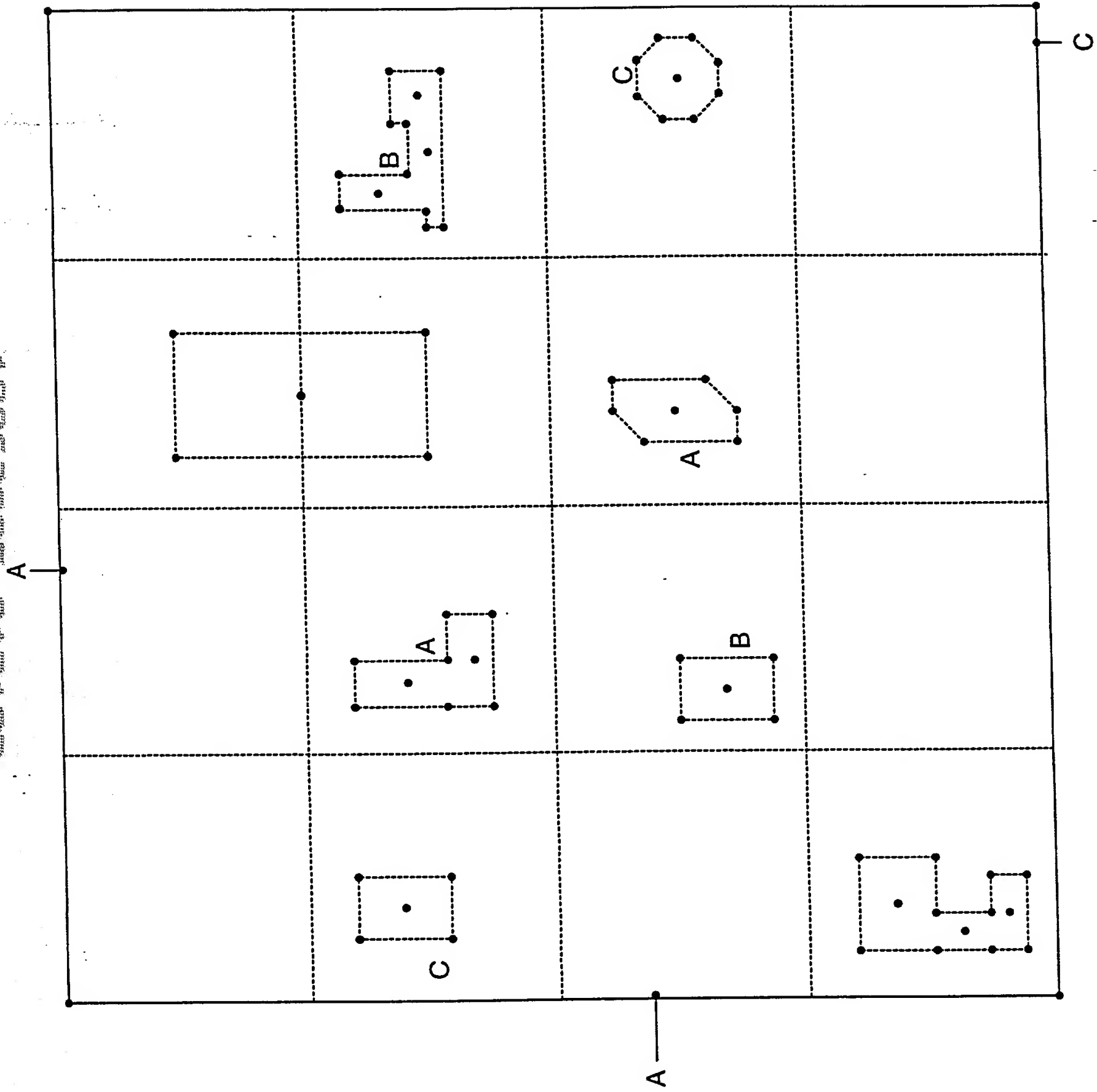
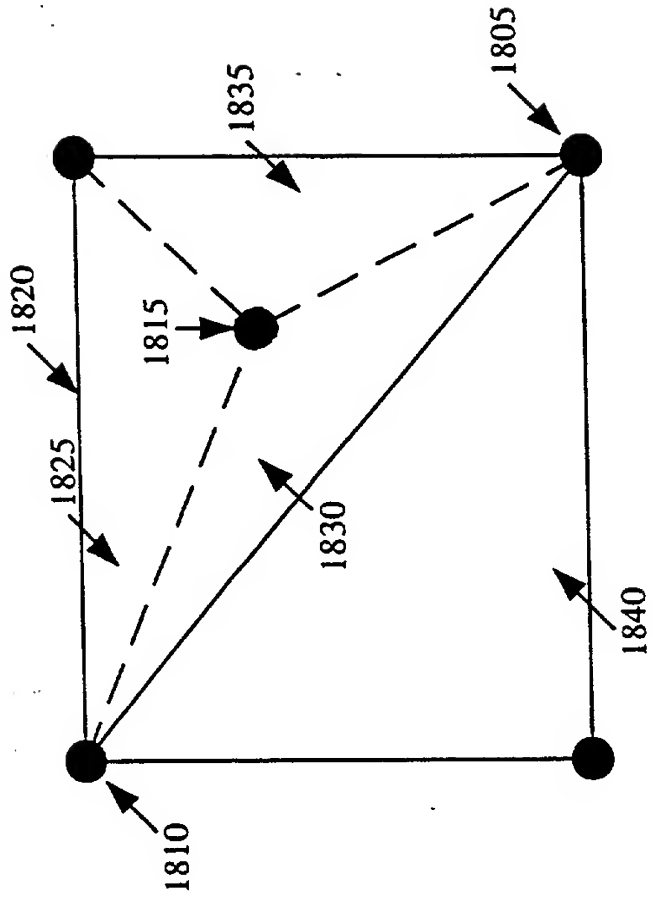
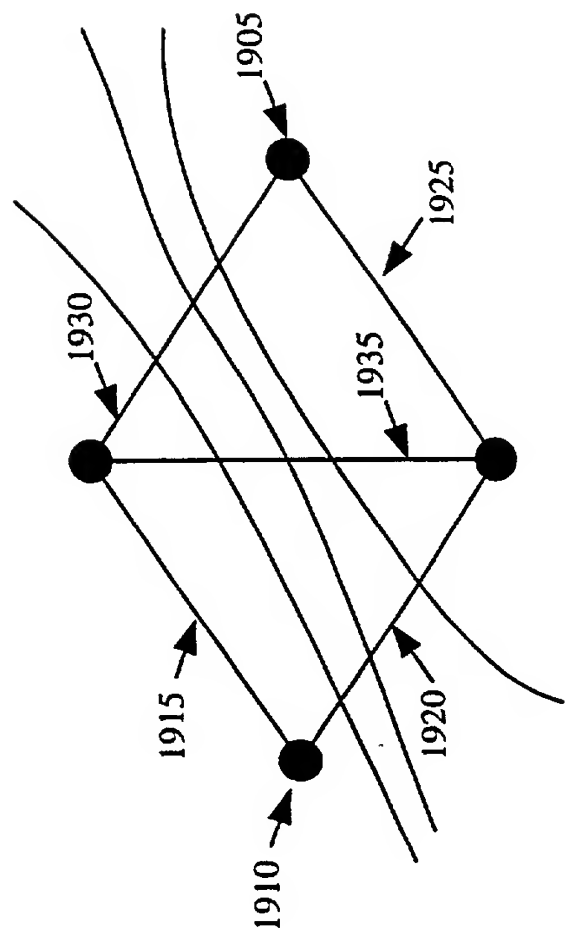


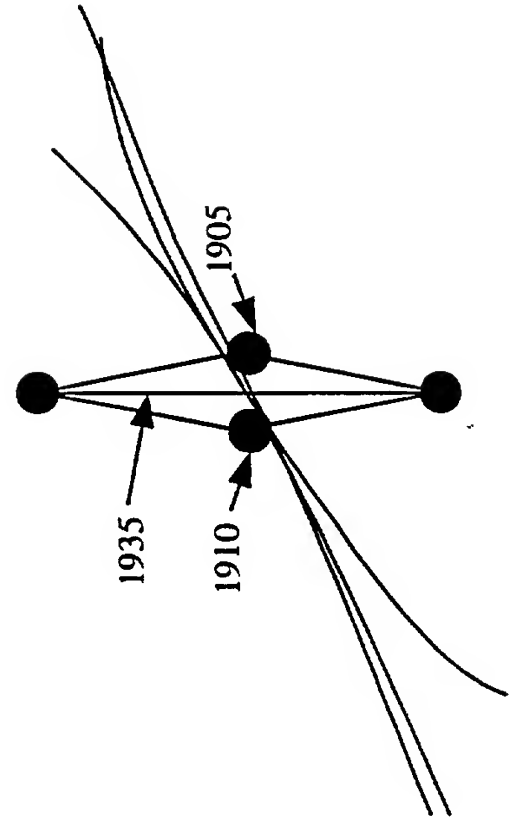
Figure 17



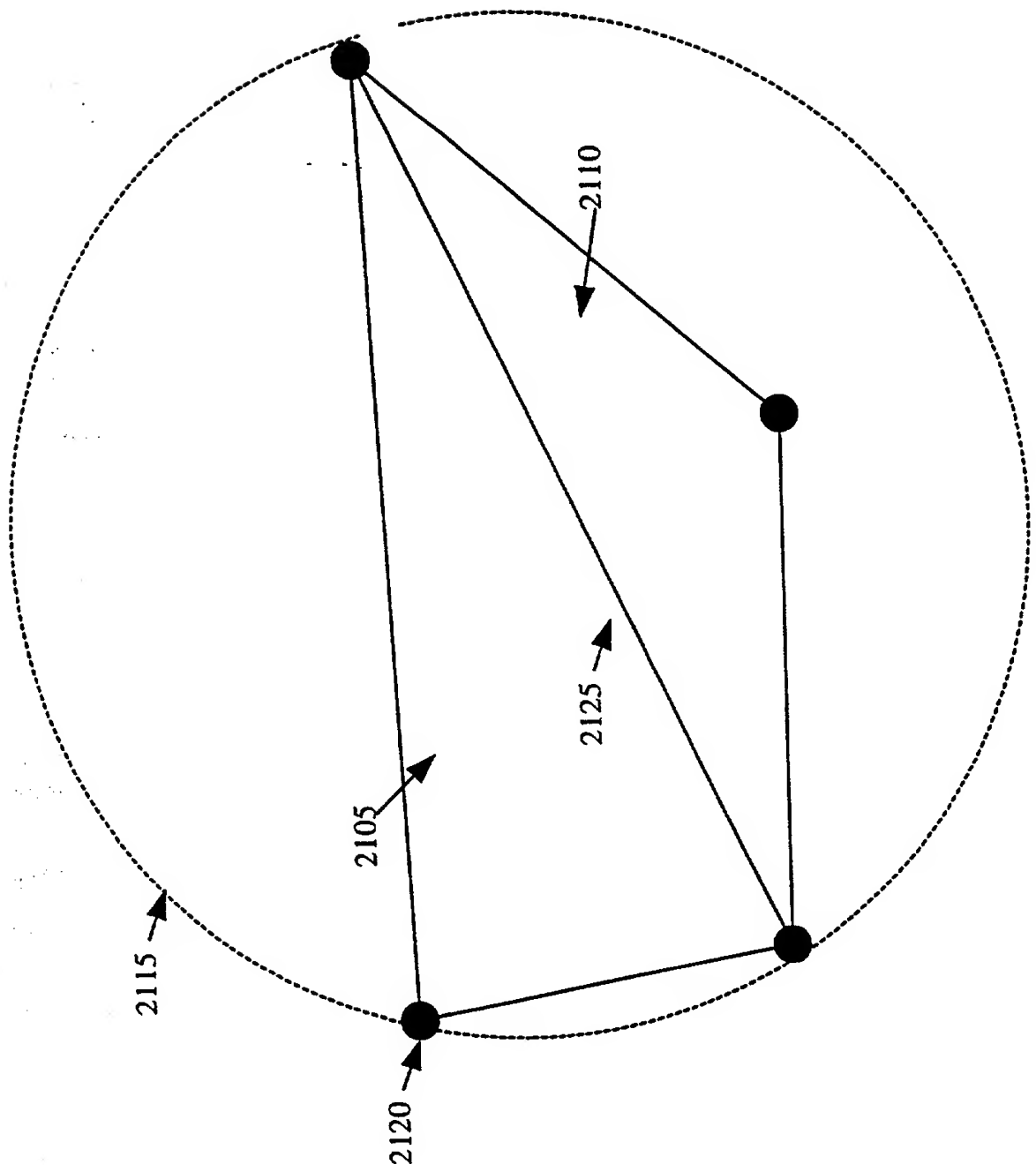
*Figure 18*



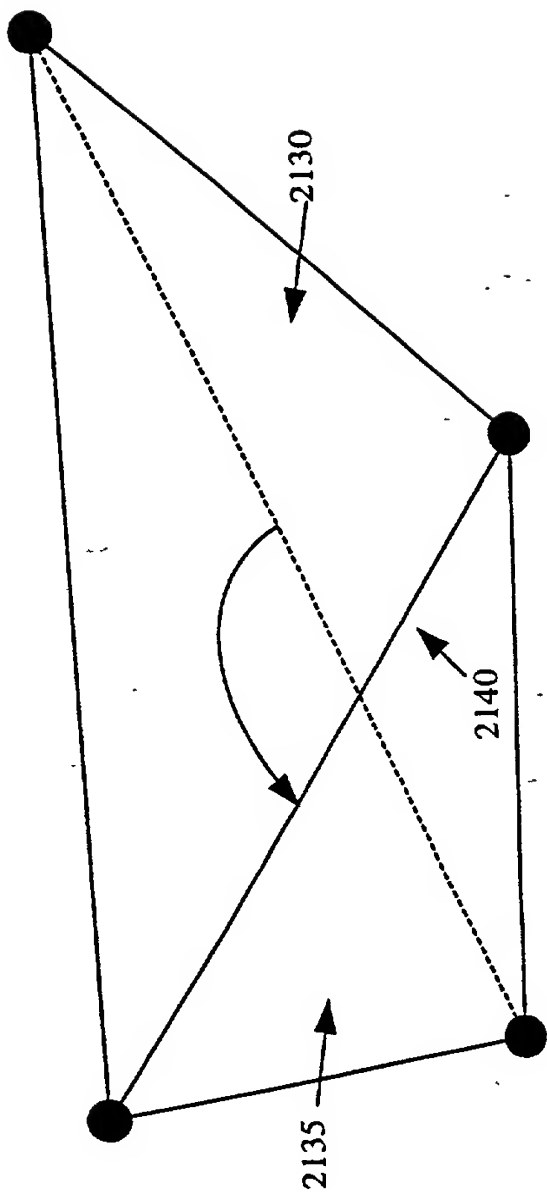
*Figure 19*



*Figure 20*

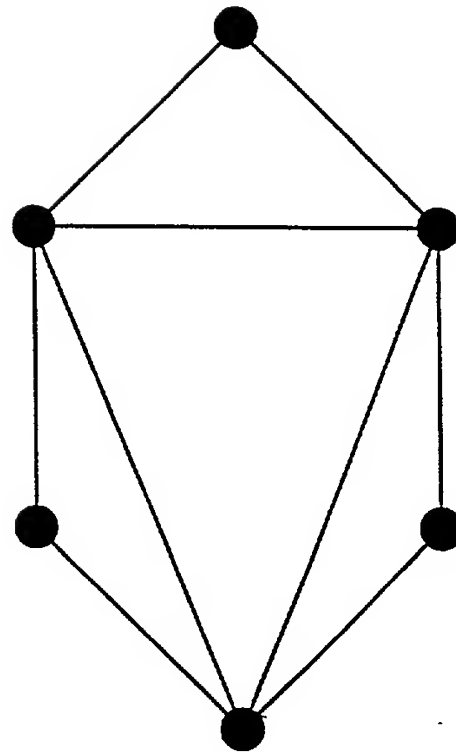
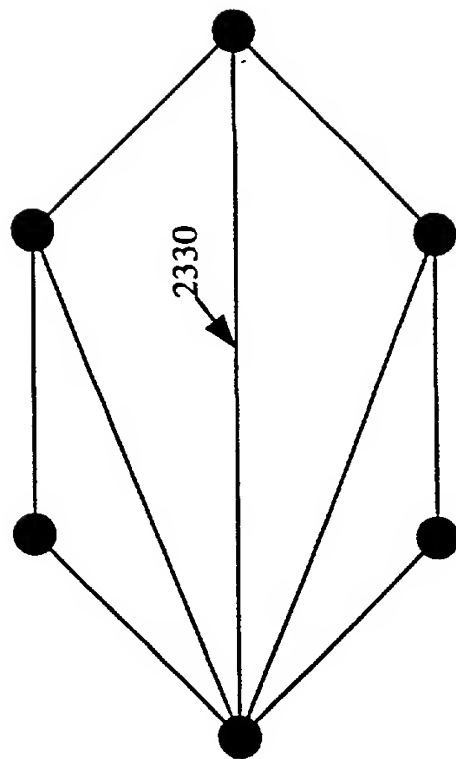
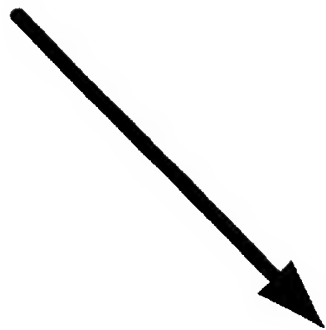
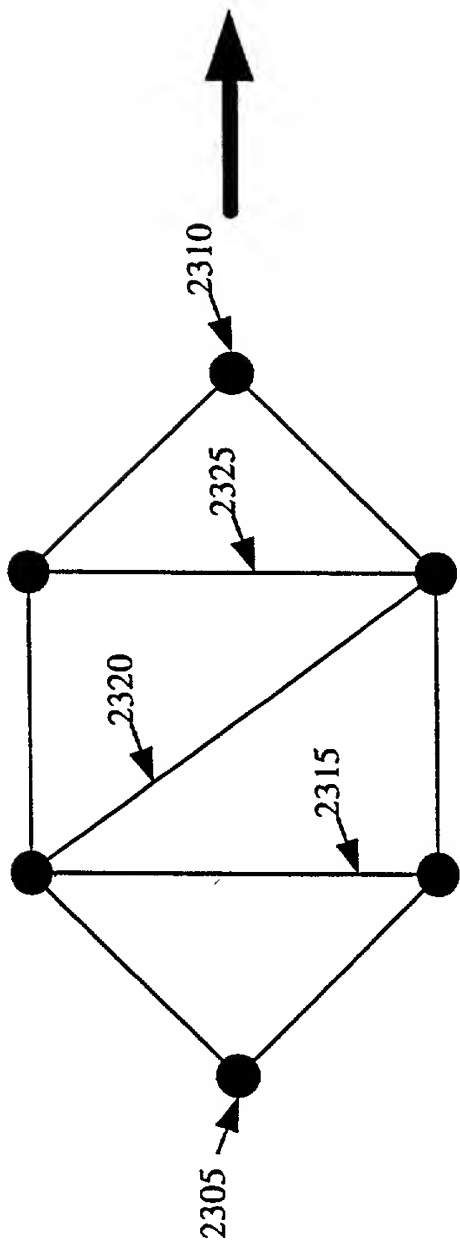
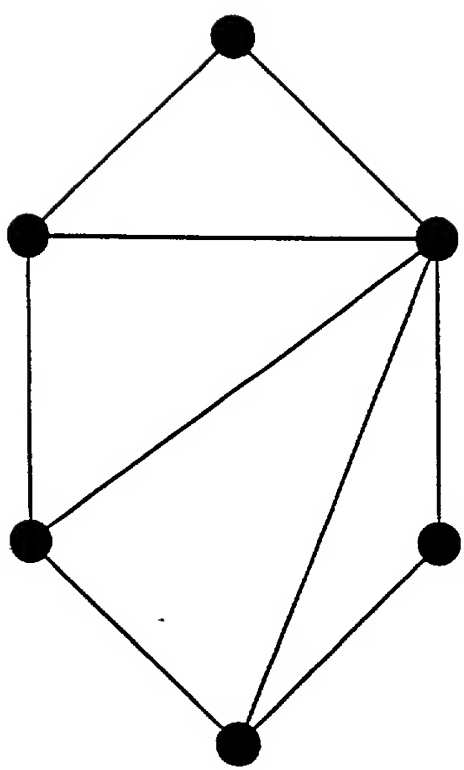


*Figure 21*



*Figure 22*





*Figure 23*

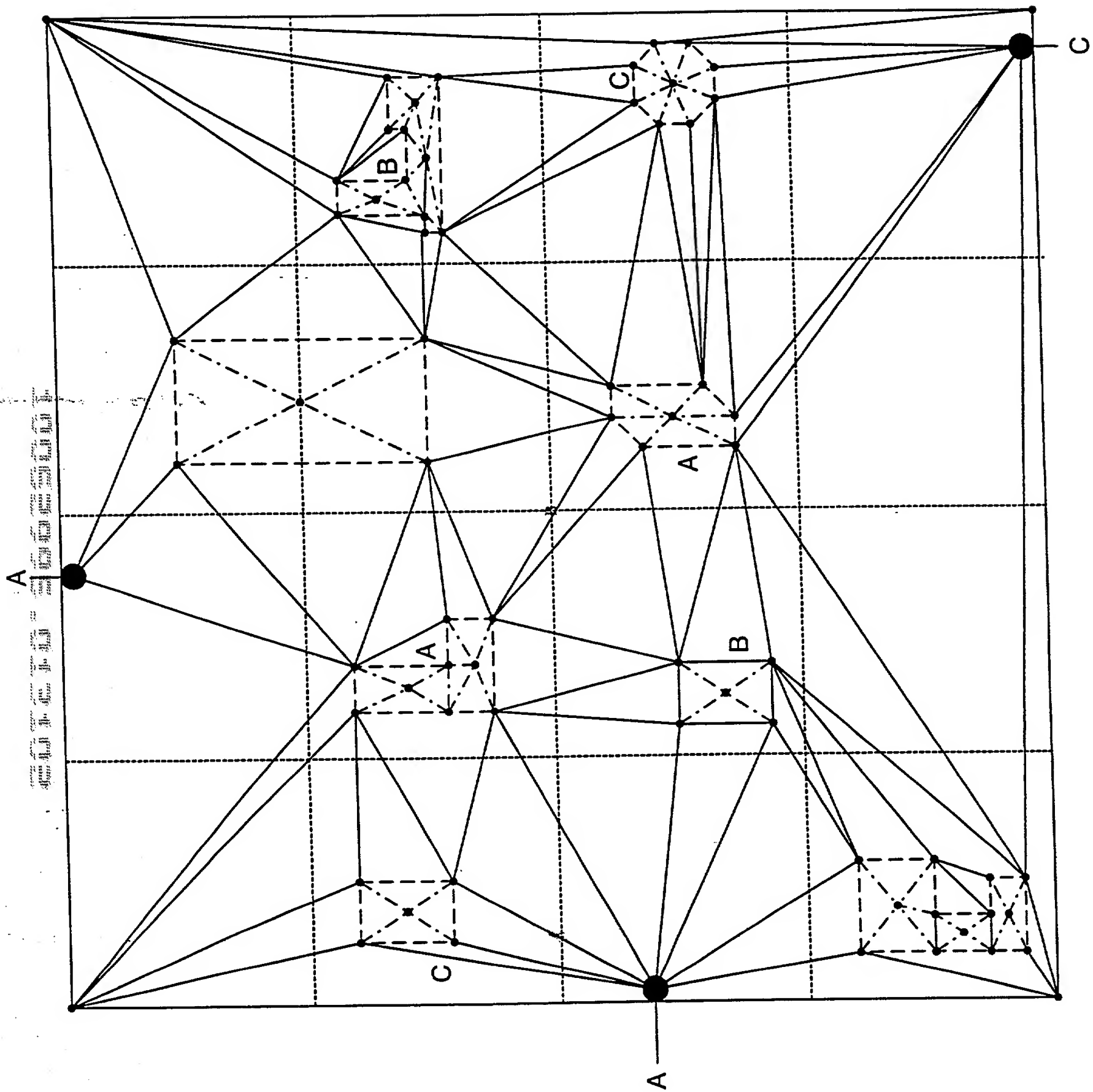
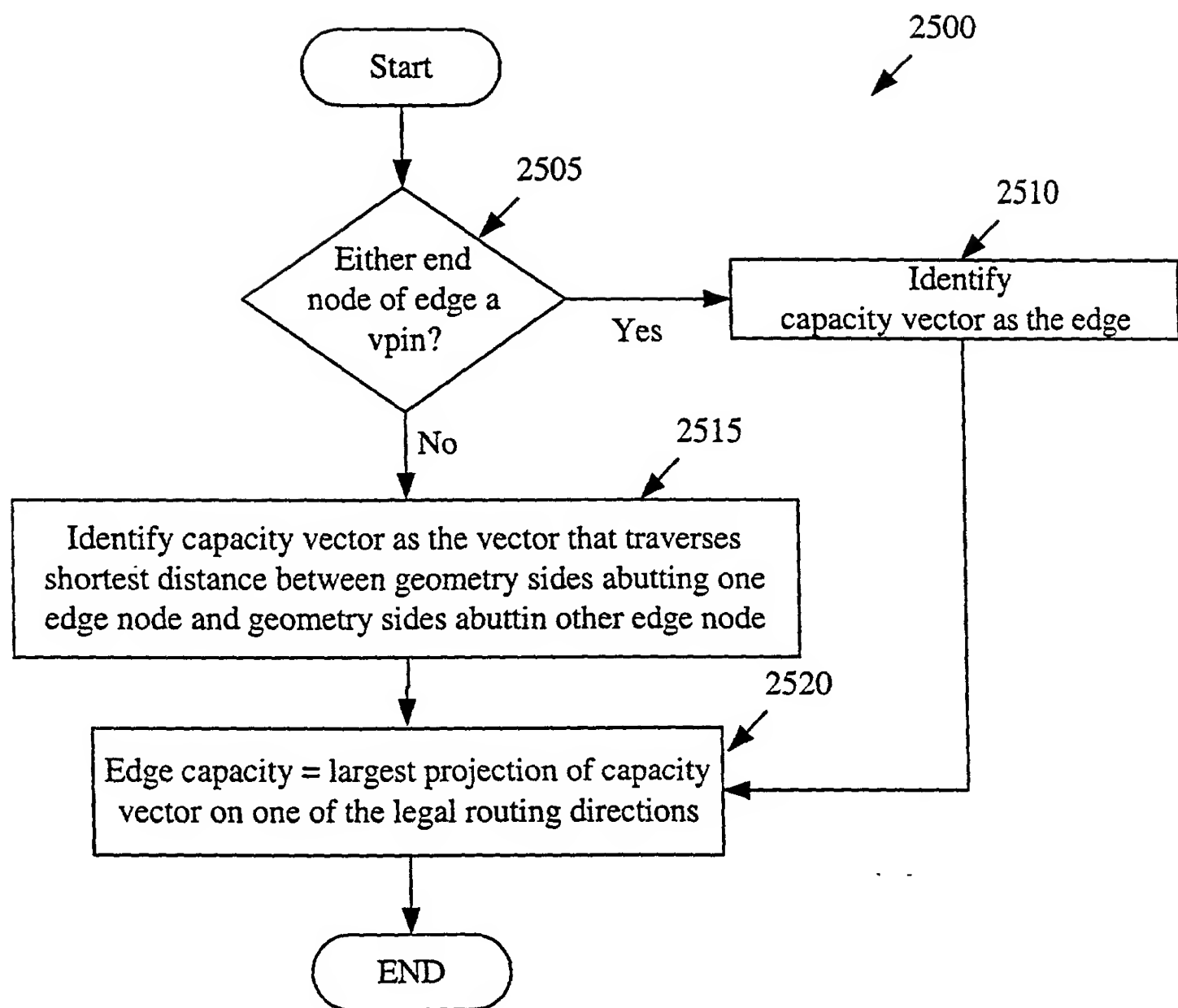


Figure 24



**Figure 25**

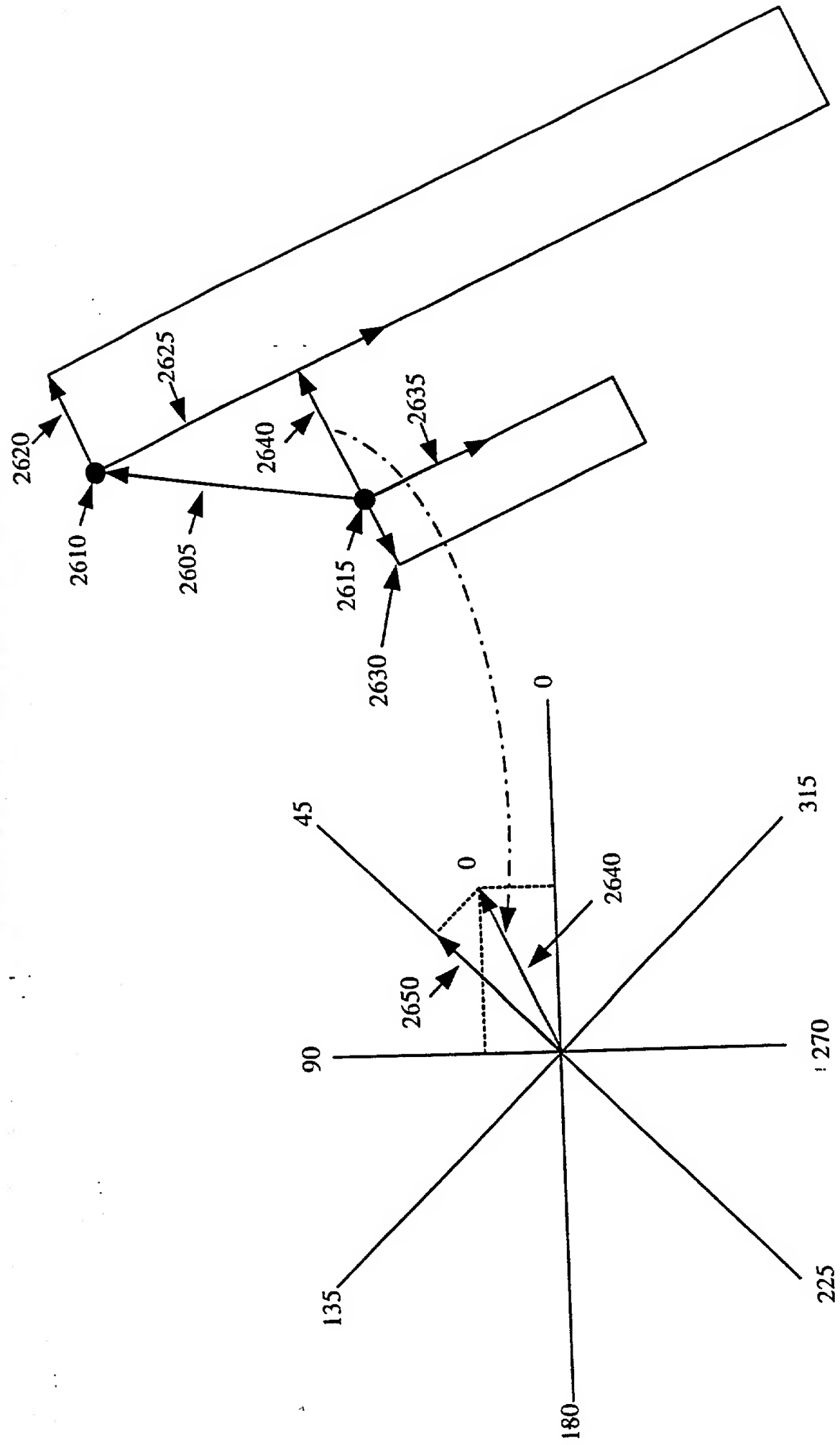


Figure 26

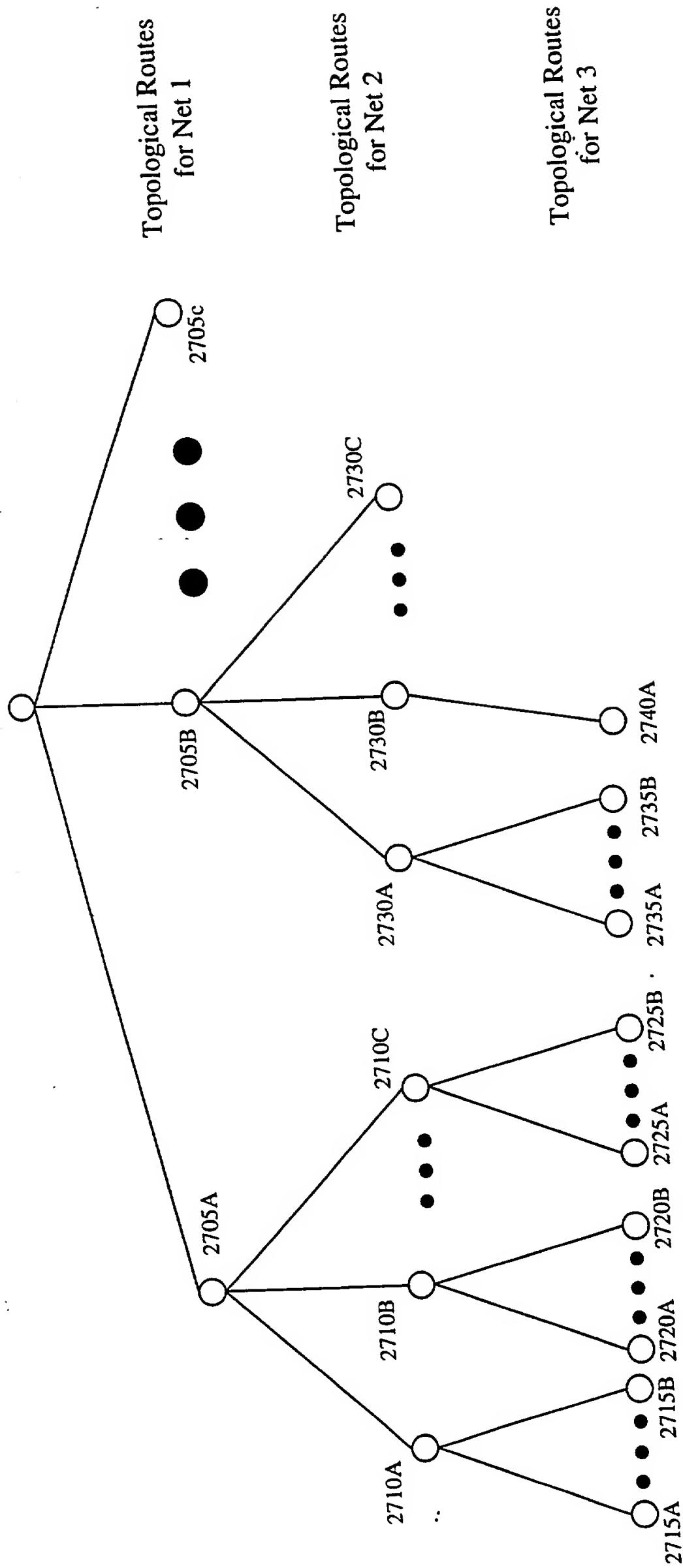
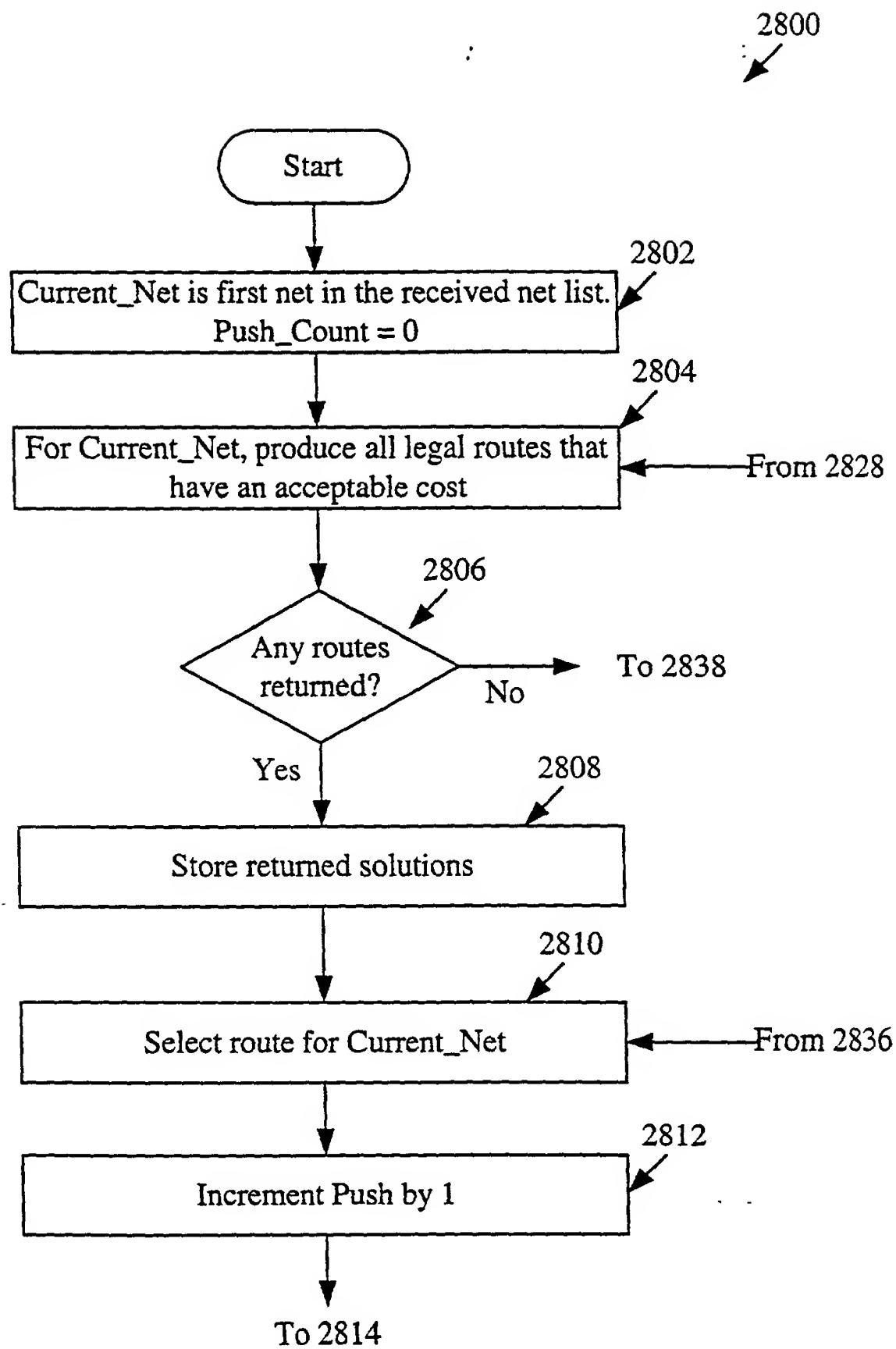
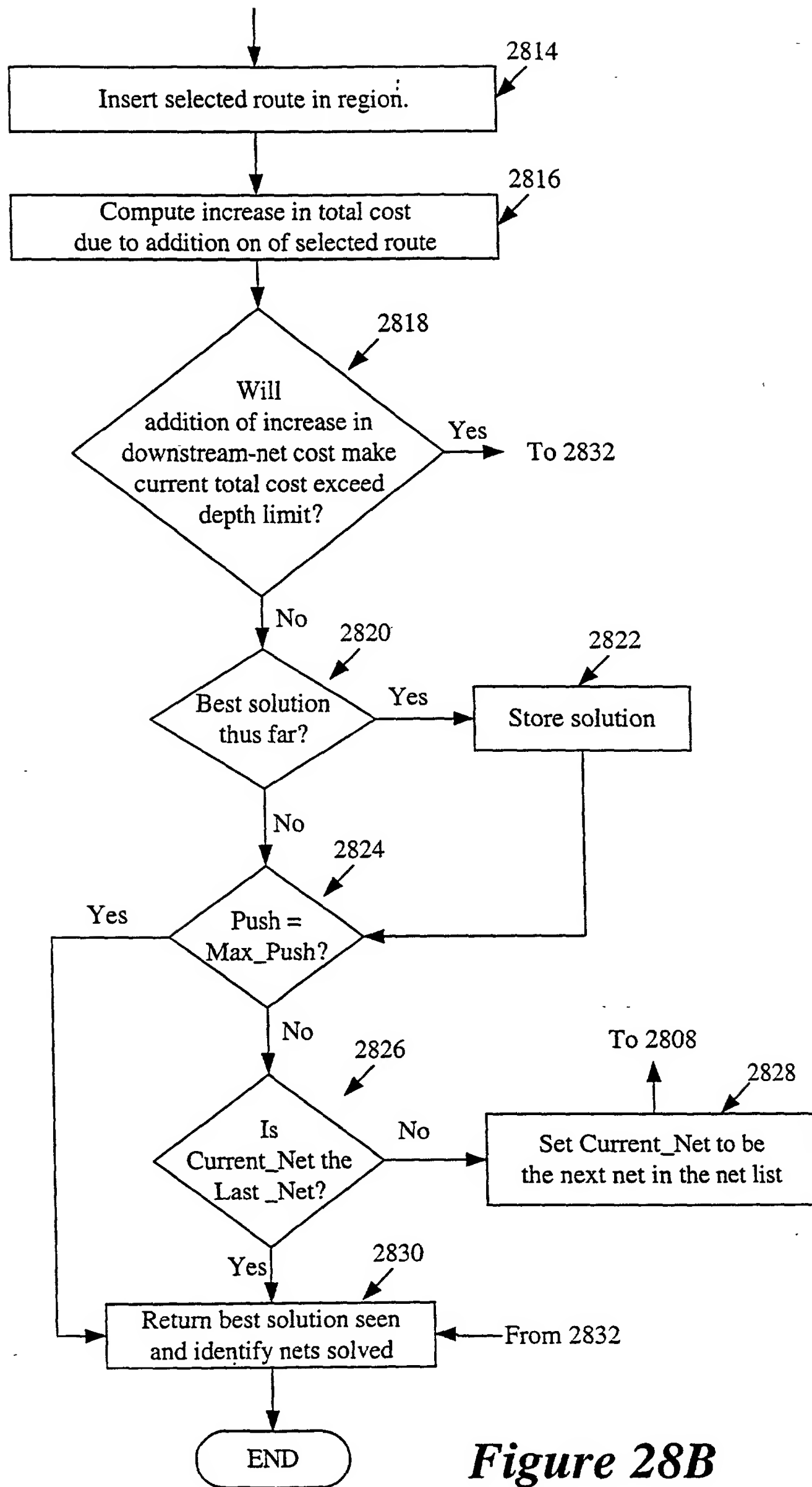


Figure 27

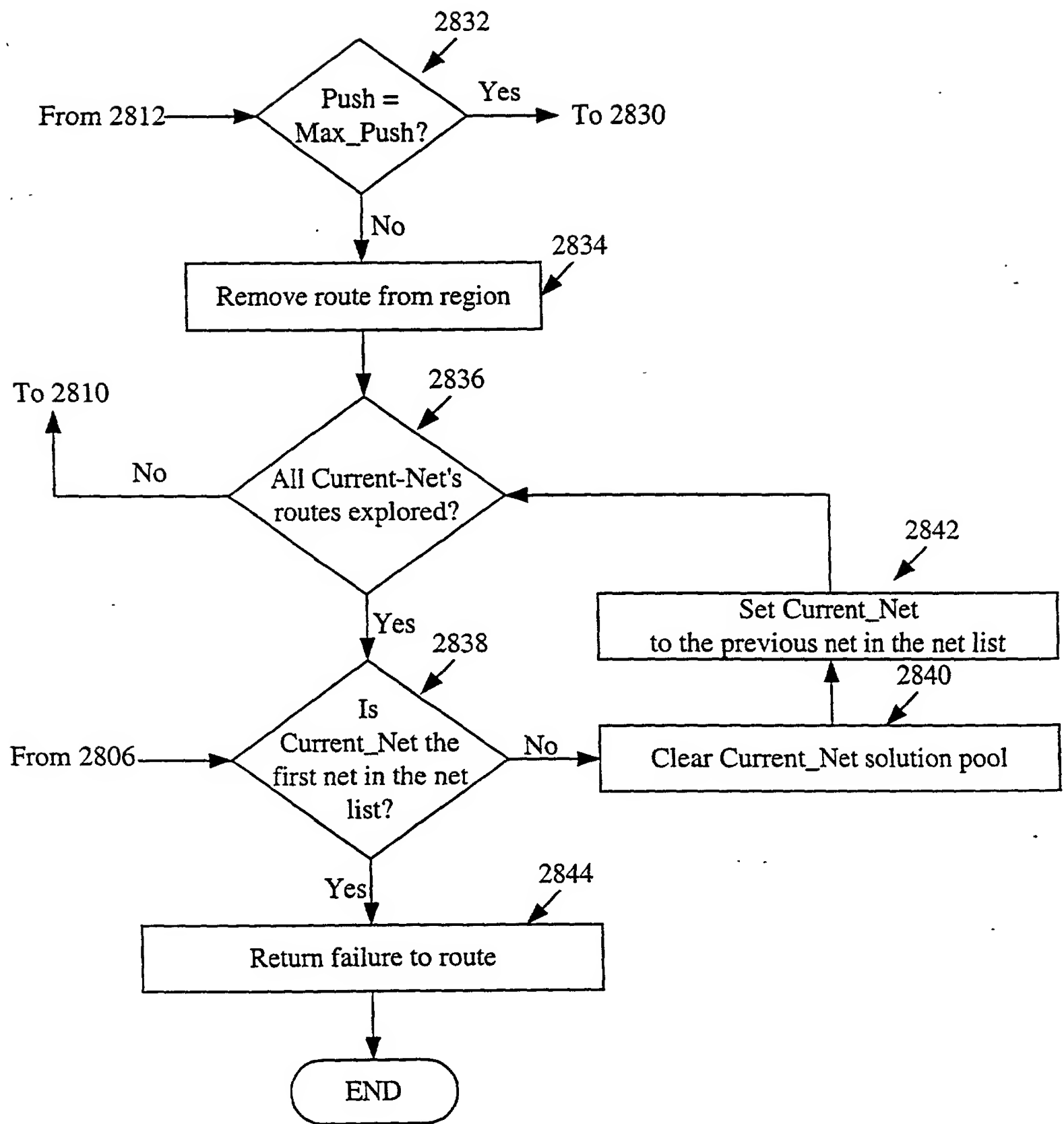


**Figure 28A**

**Figure 28:** Figure 28A  
Figure 28B  
Figure 28C

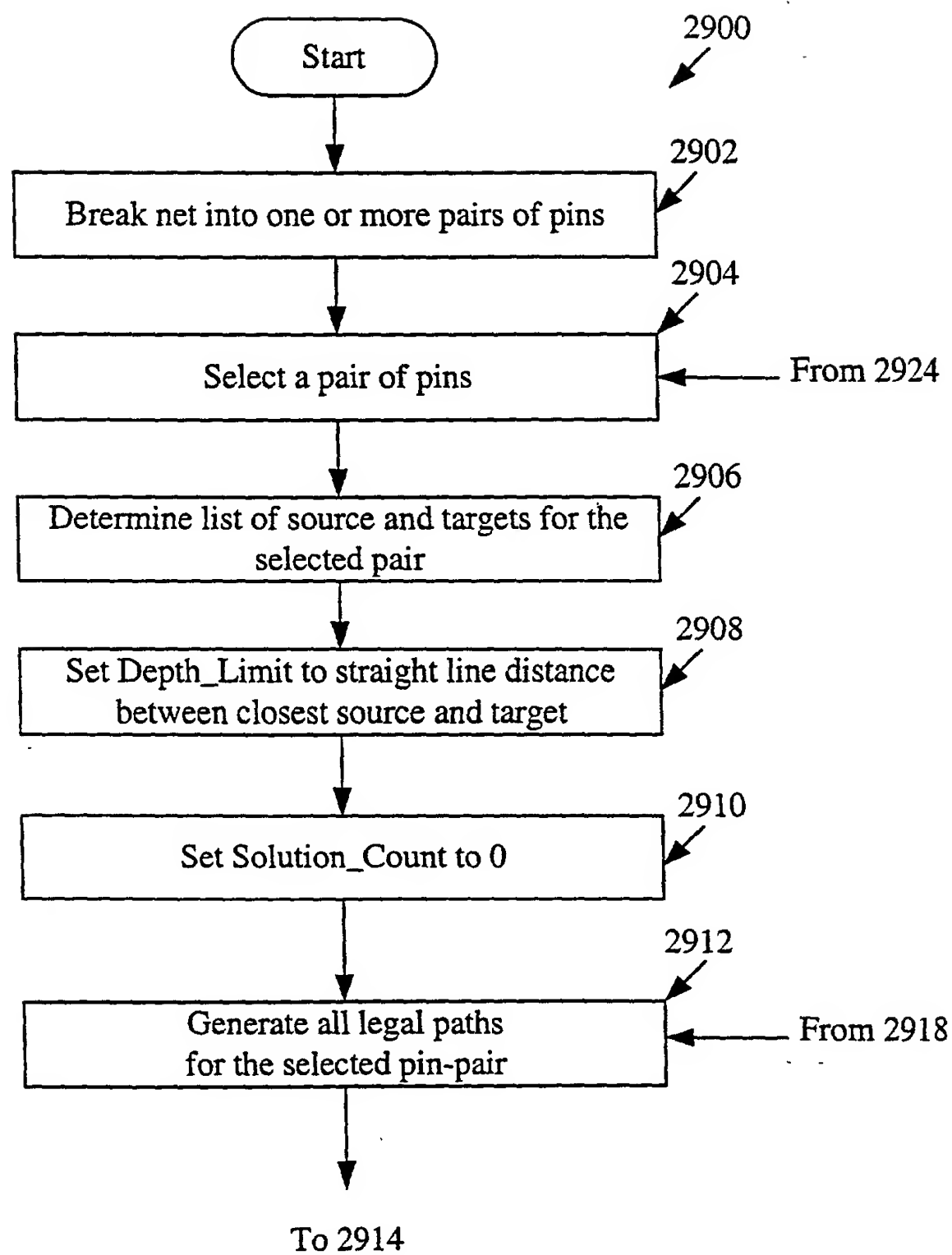


**Figure 28B**



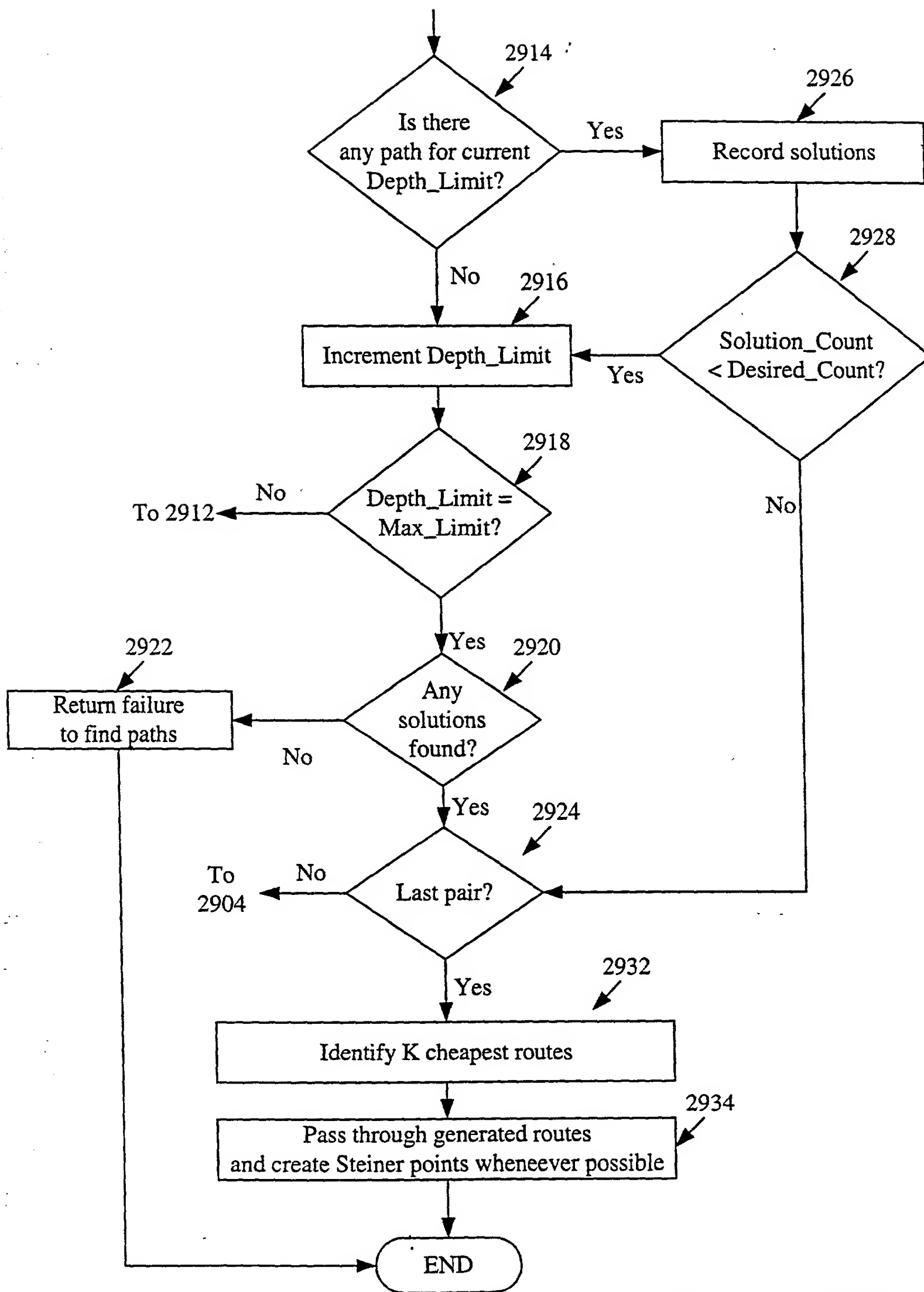
*Figure 28C*





**Figure 29A**

**Figure 29:  $\frac{\text{Figure 29A}}{\text{Figure 29B}}$**



**Figure 29B**

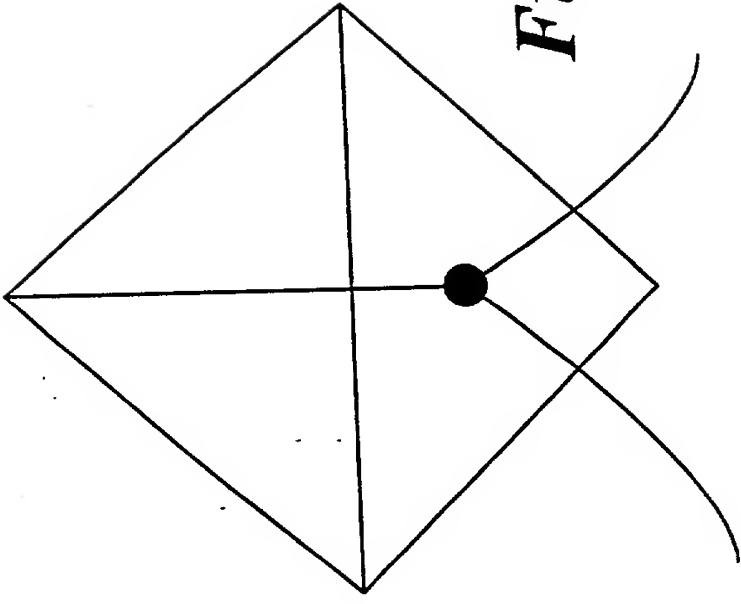


Figure 30B

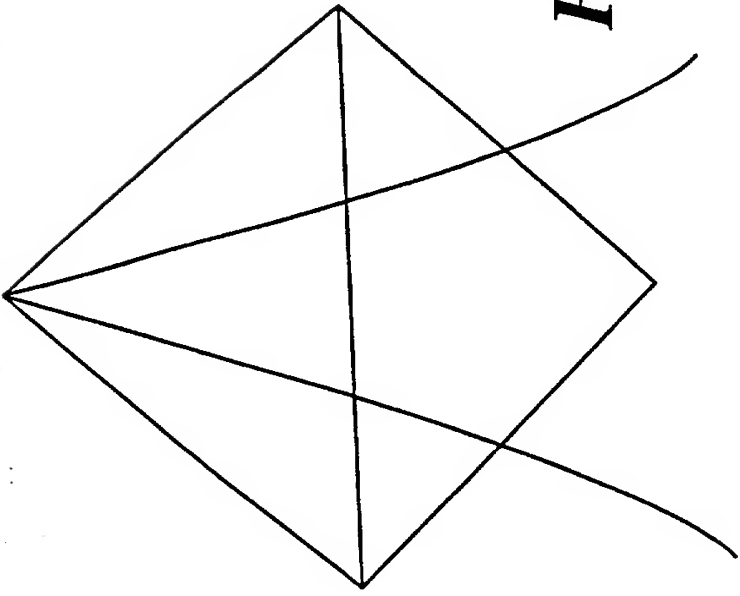


Figure 30A

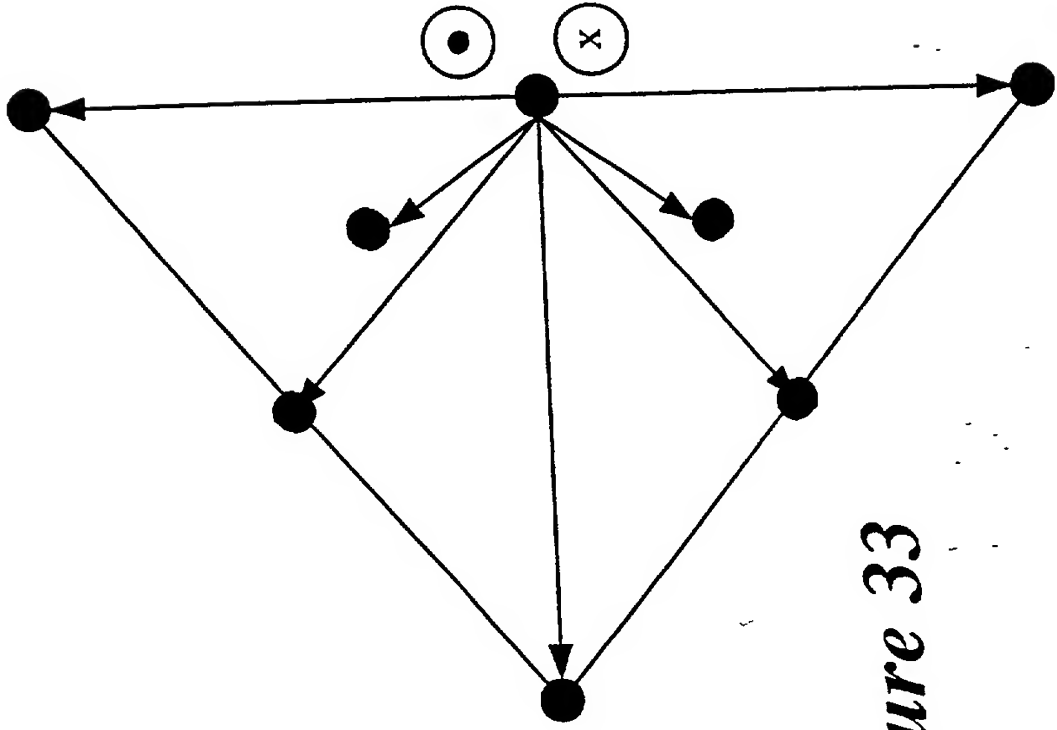


Figure 33

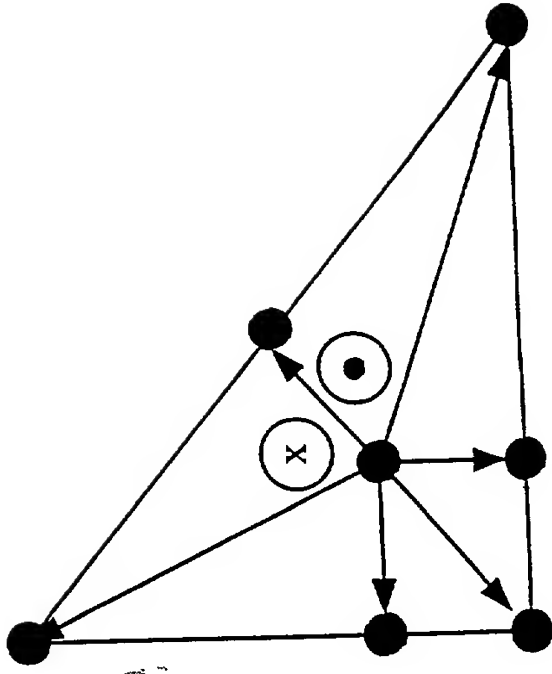


Figure 34

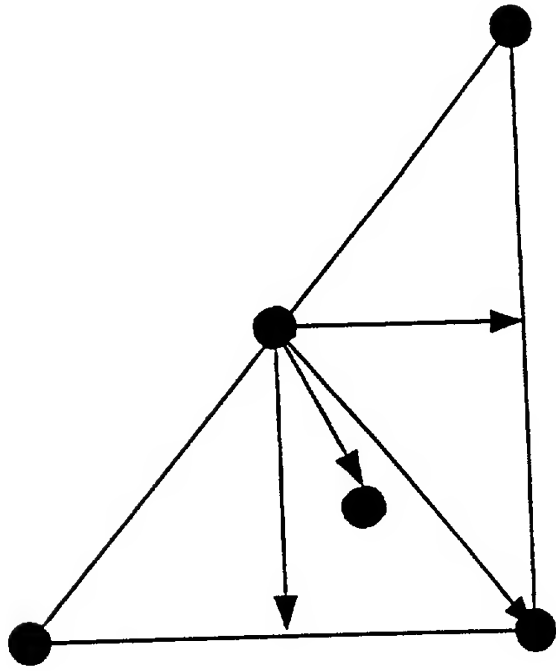
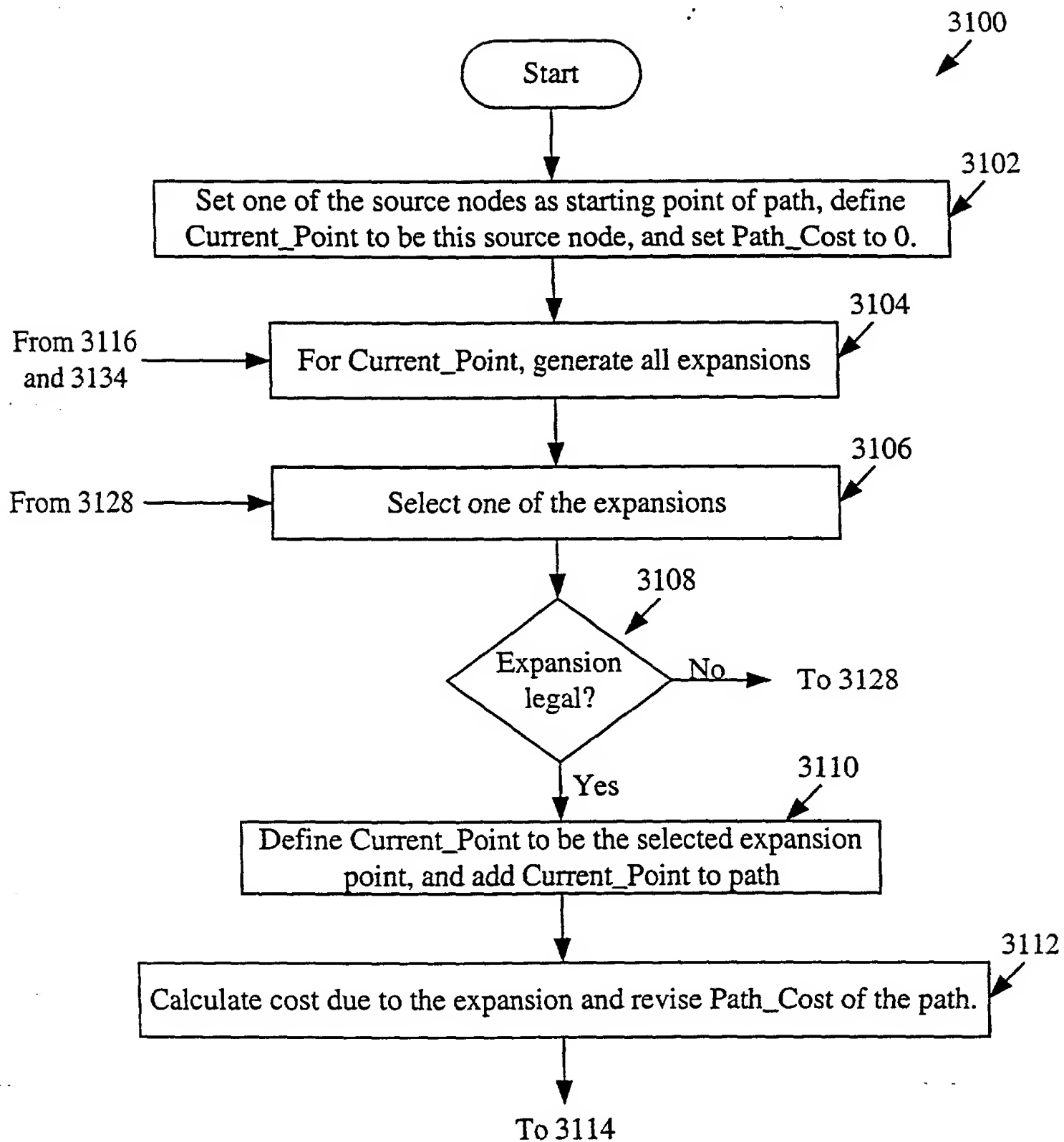
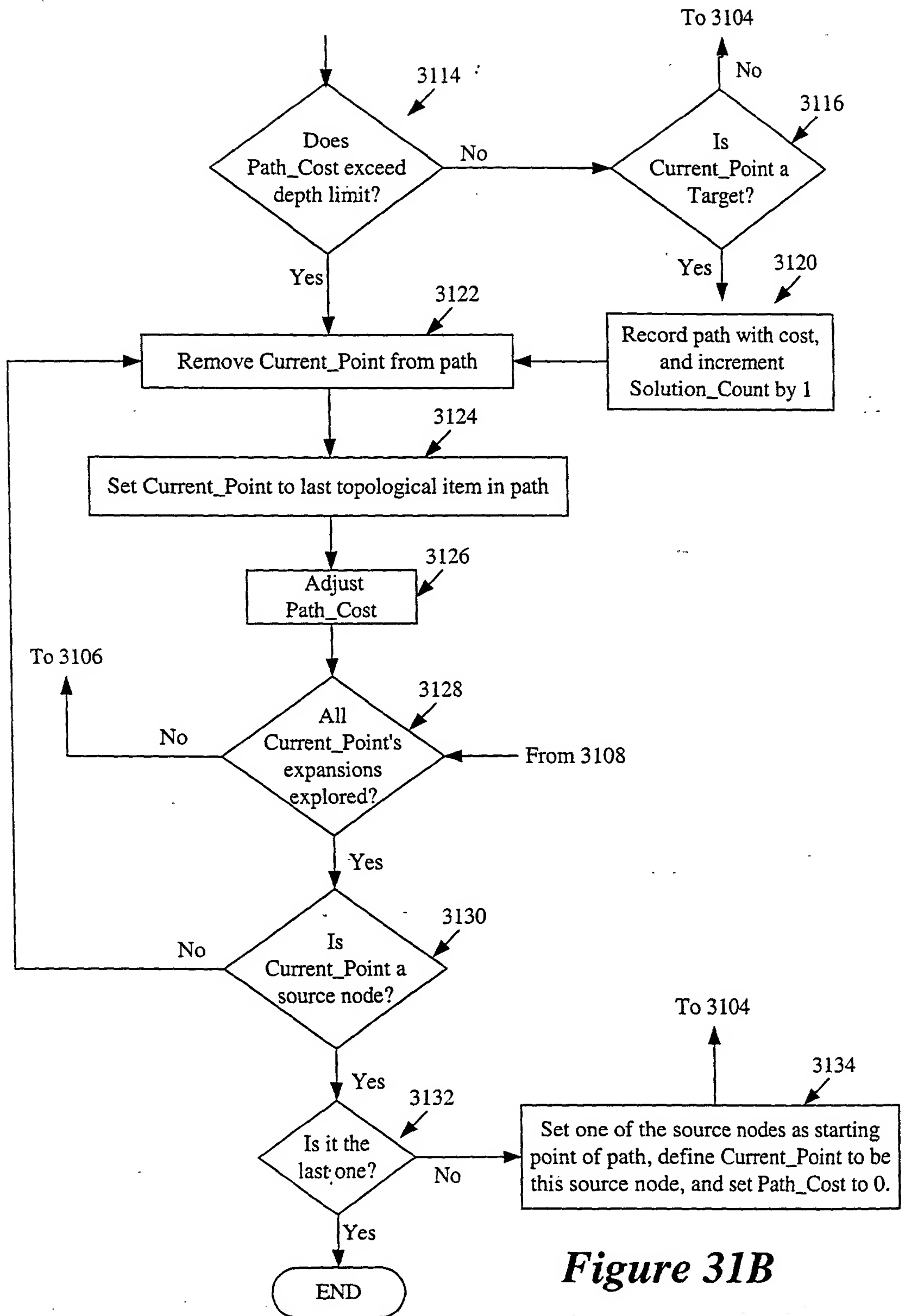


Figure 32



**Figure 31A**

**Figure 31:**  $\frac{\text{Figure 31A}}{\text{Figure 31B}}$



**Figure 31B**

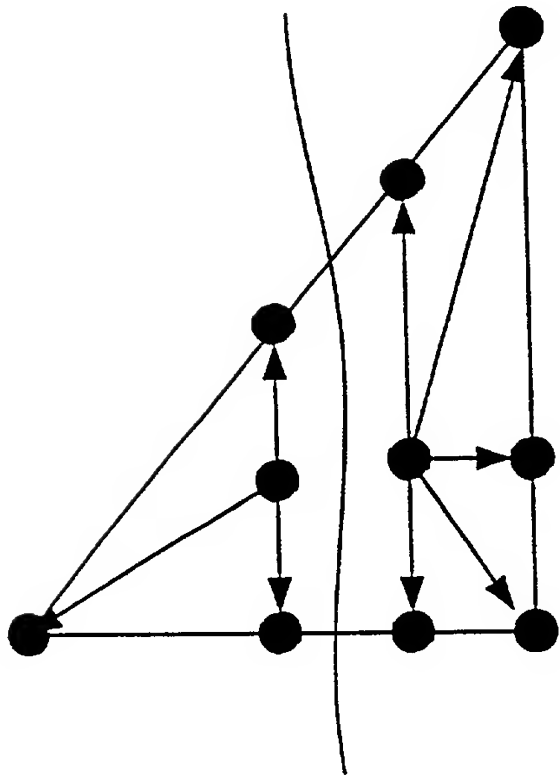


Figure 35

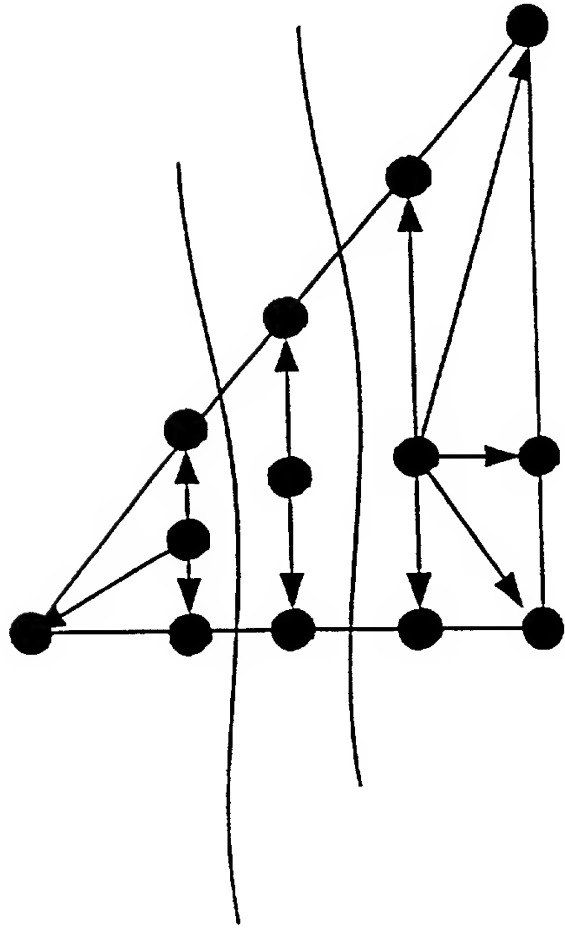


Figure 36

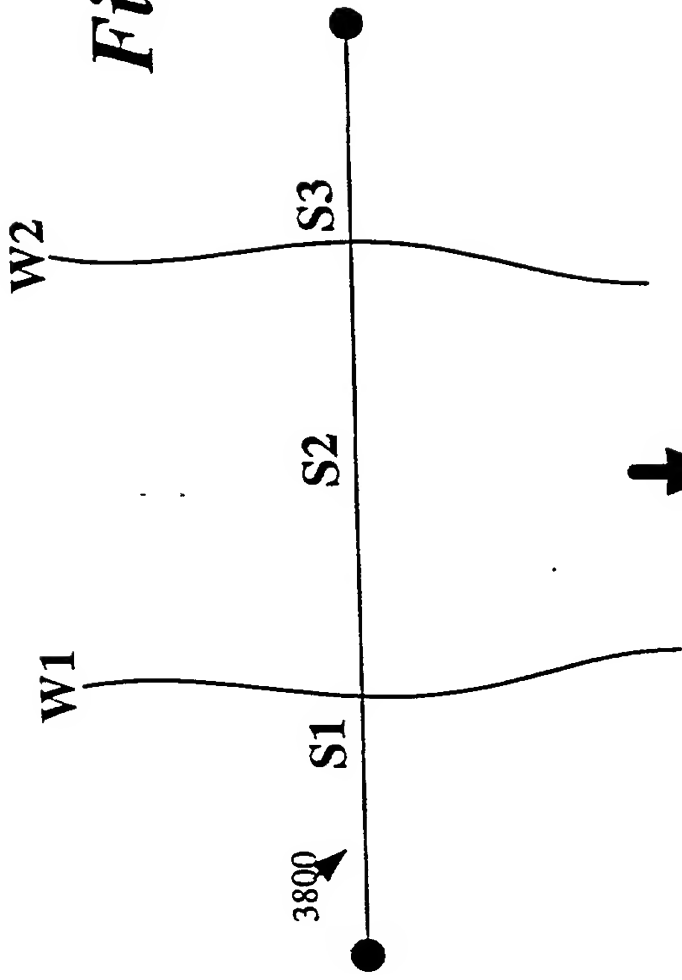


Figure 38A

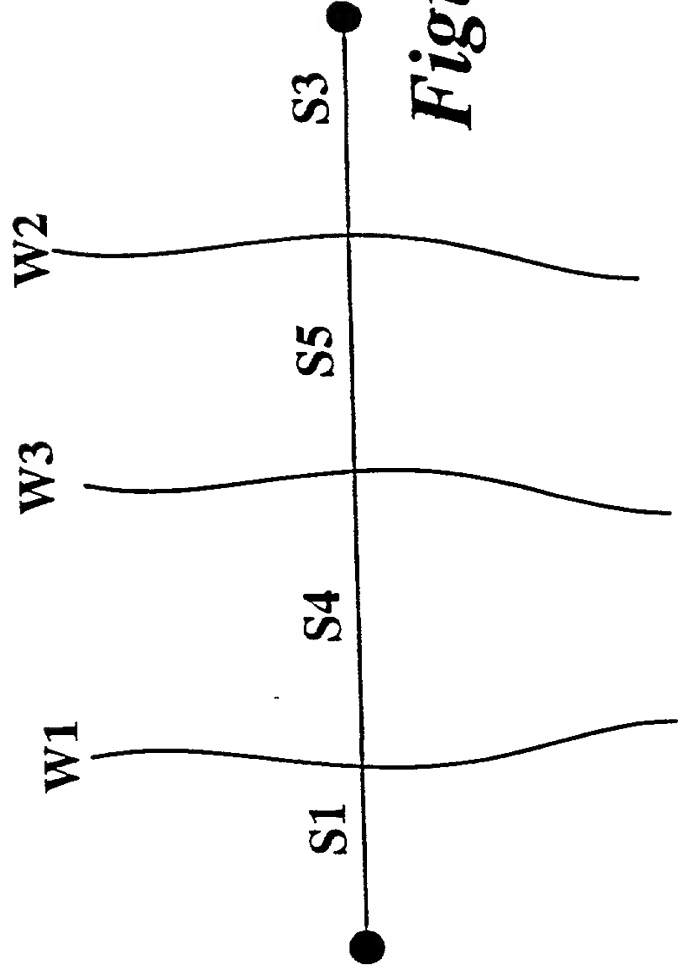
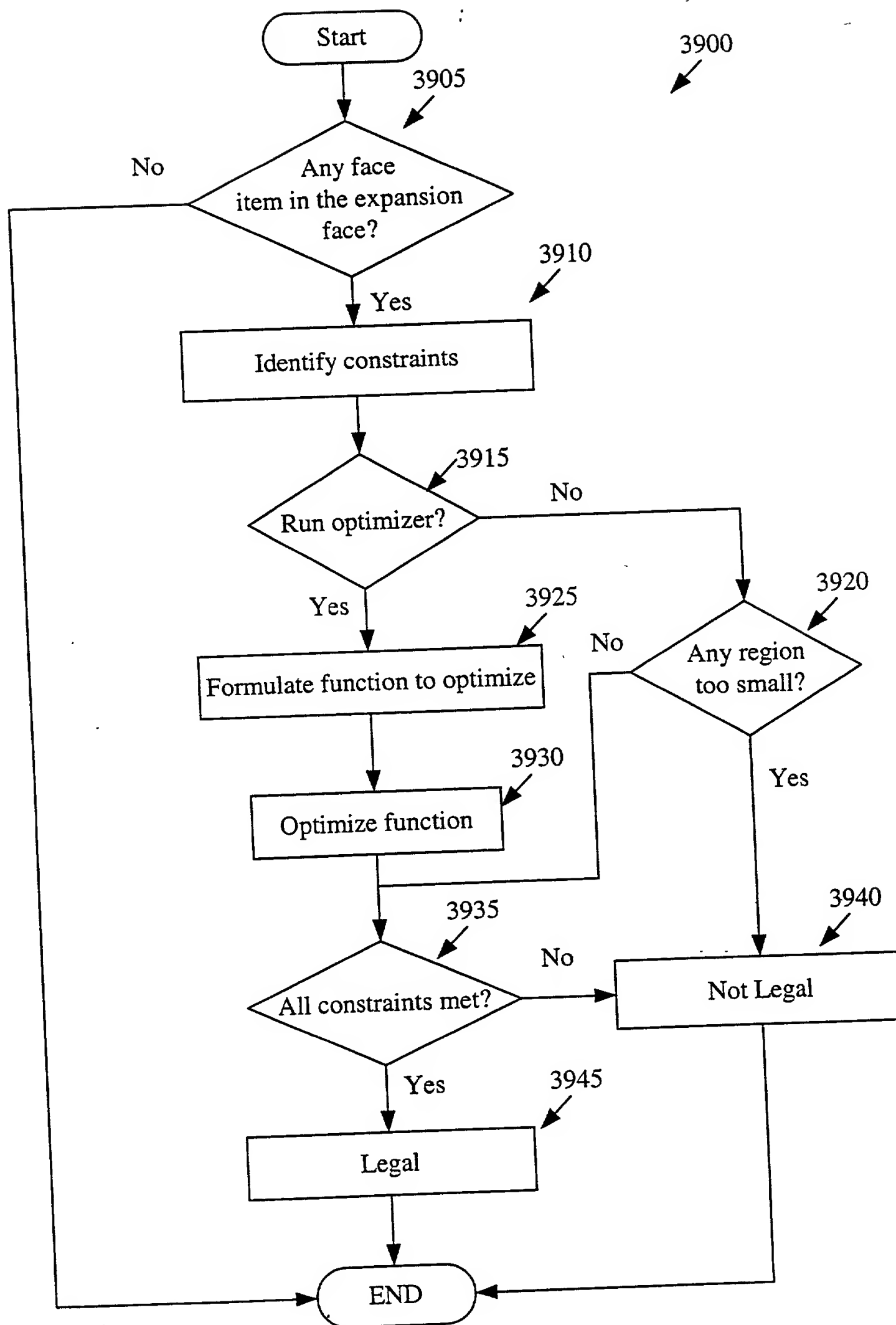


Figure 38B

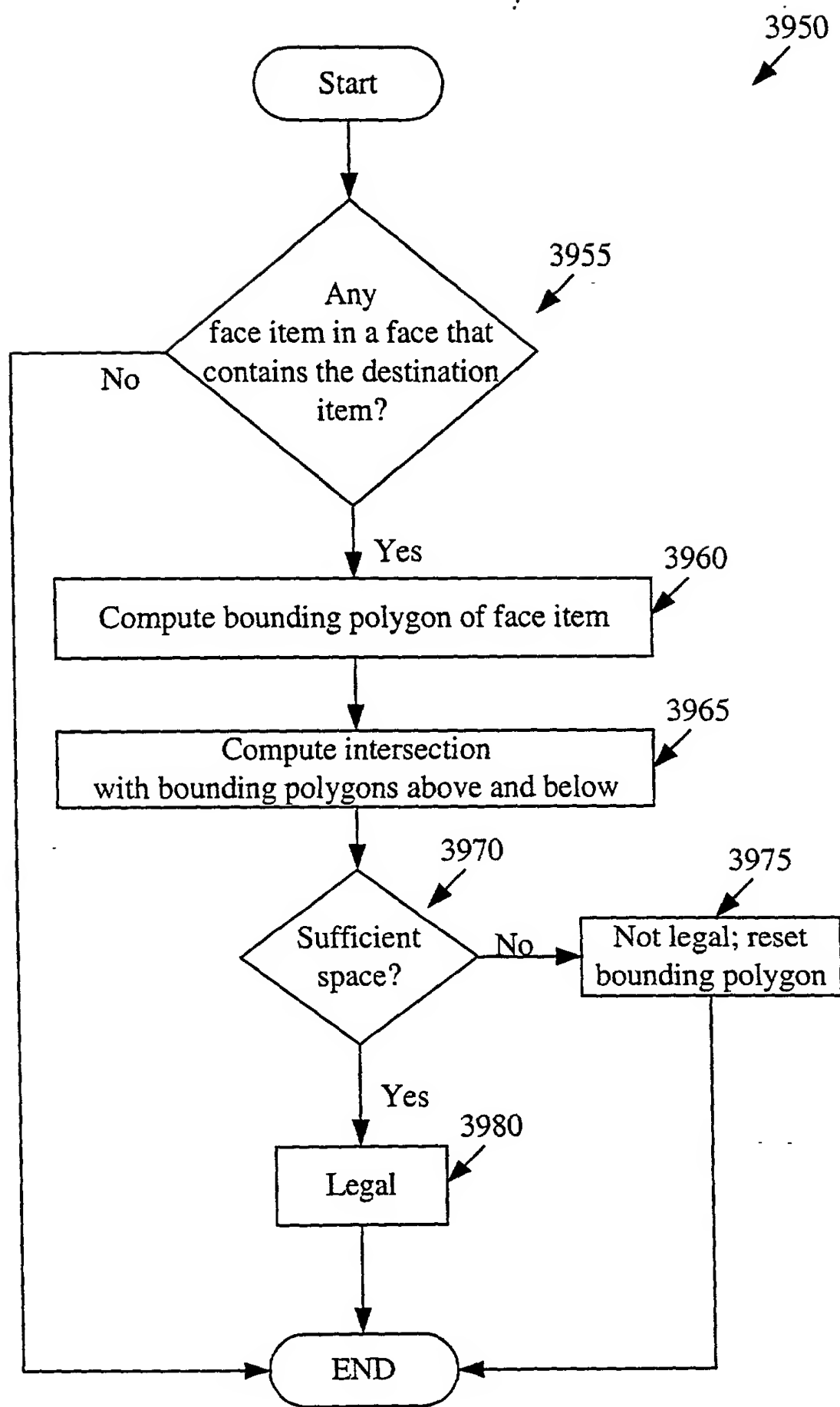
To:		Node	Face Item	Edge Item
From:	Node	<ul style="list-style-type: none"> <li>• Planarity</li> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Planarity</li> <li>• Vias</li> <li>• Edge Capacity</li> </ul>
	Face Item	<ul style="list-style-type: none"> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Vias</li> <li>• Edge Capacity</li> </ul>
	Edge Item	<ul style="list-style-type: none"> <li>• Planarity</li> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Vias</li> </ul>	<ul style="list-style-type: none"> <li>• Planarity</li> <li>• Vias</li> <li>• Edge Capacity</li> </ul>

*Figure 37*

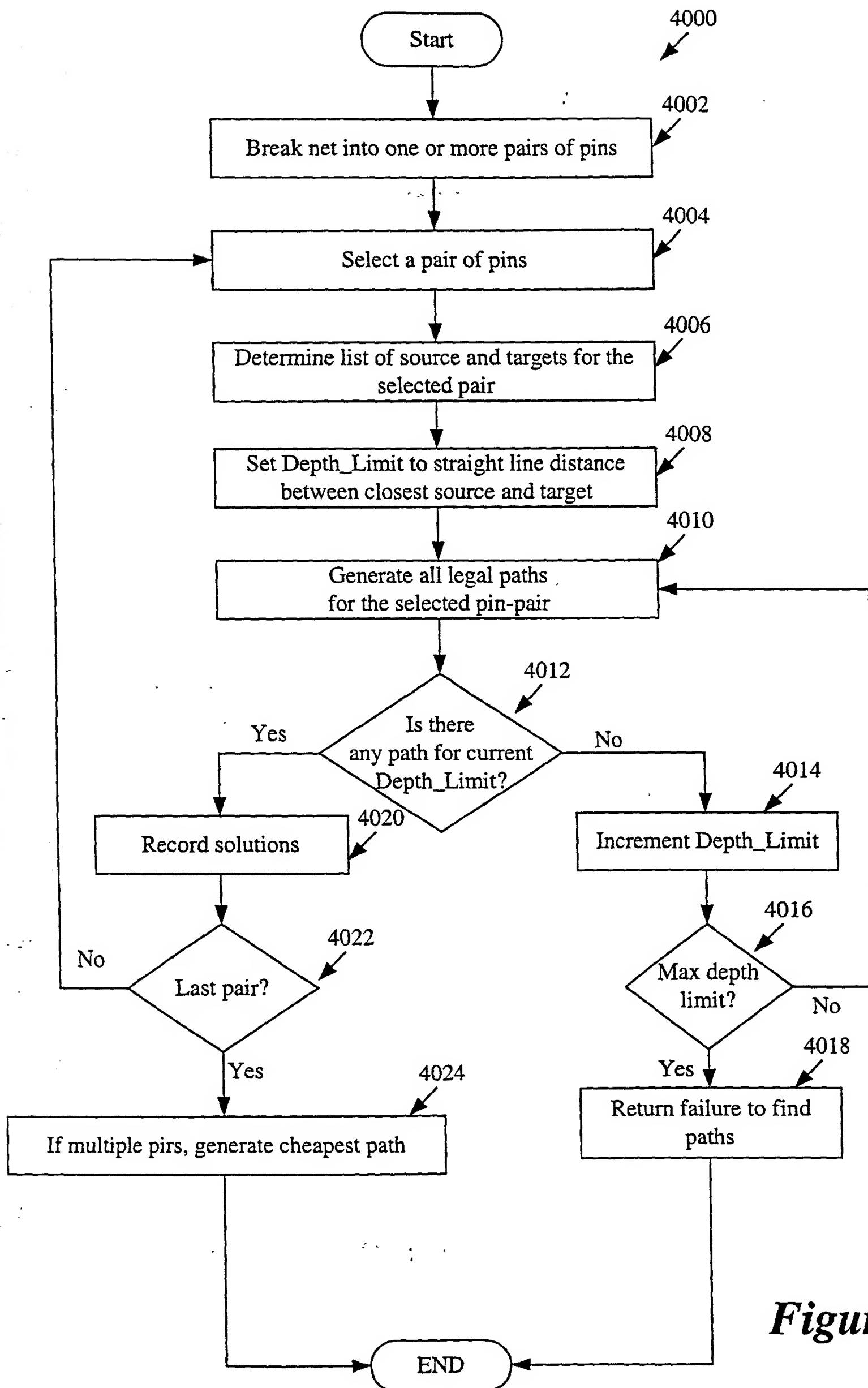


**Figure 39A**

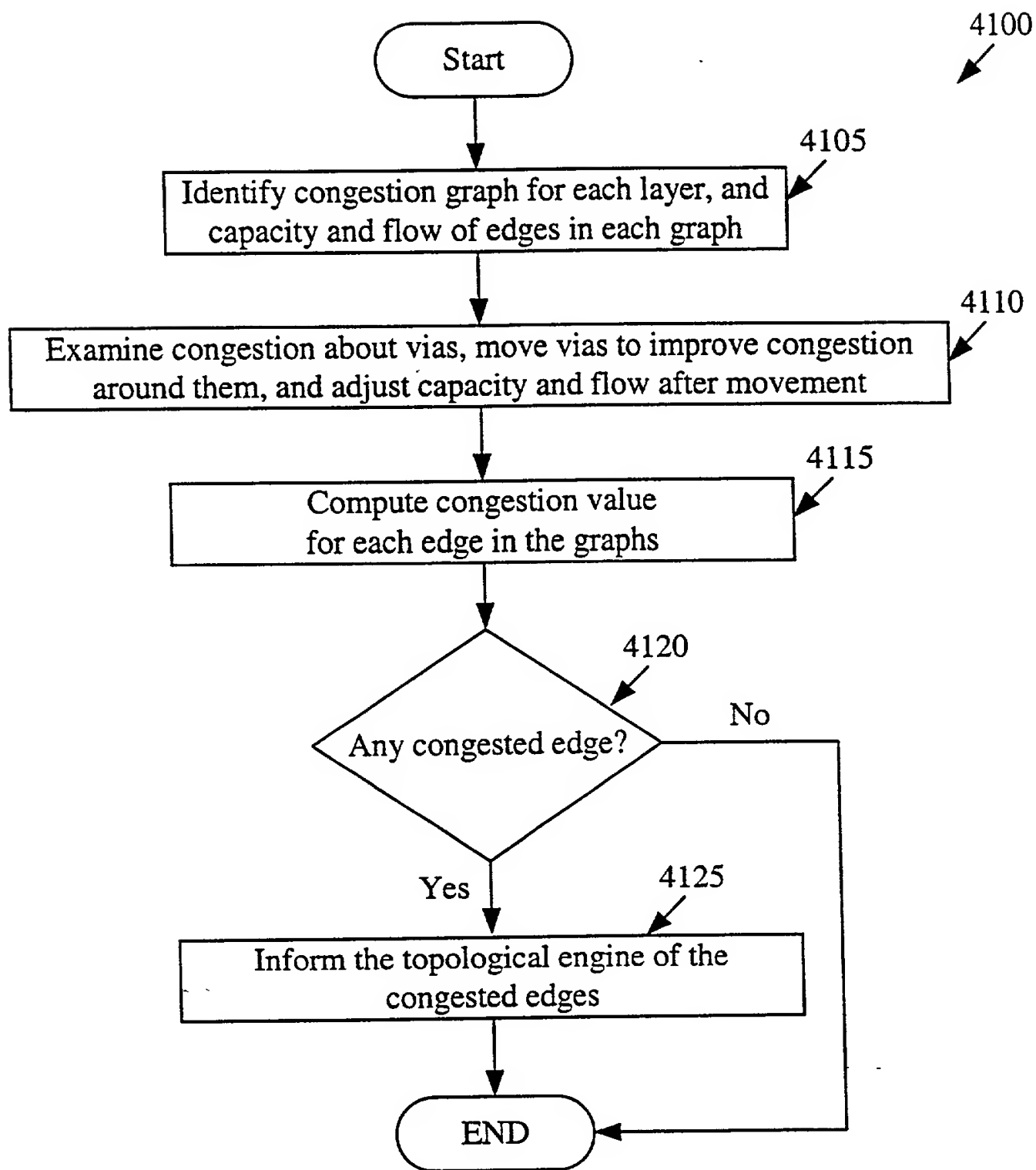




**Figure 39B**



**Figure 40**



**Figure 41**

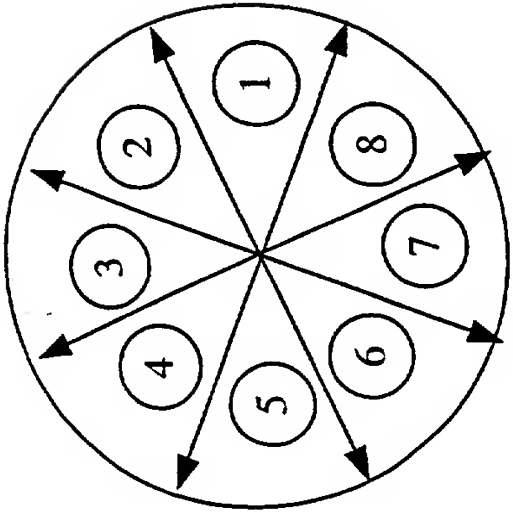


Figure 42

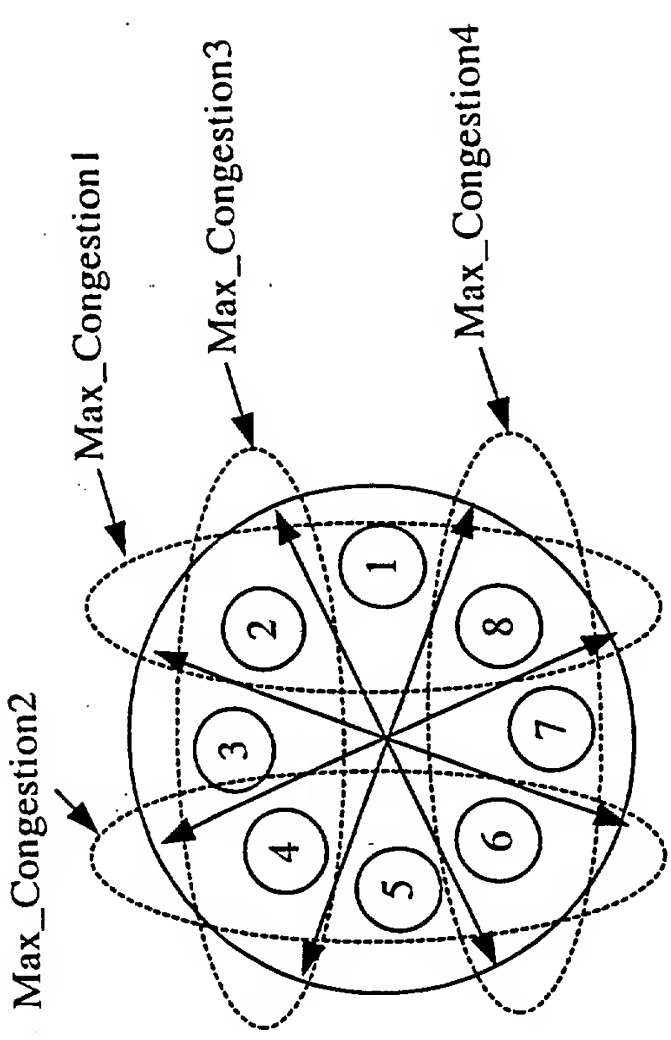


Figure 44

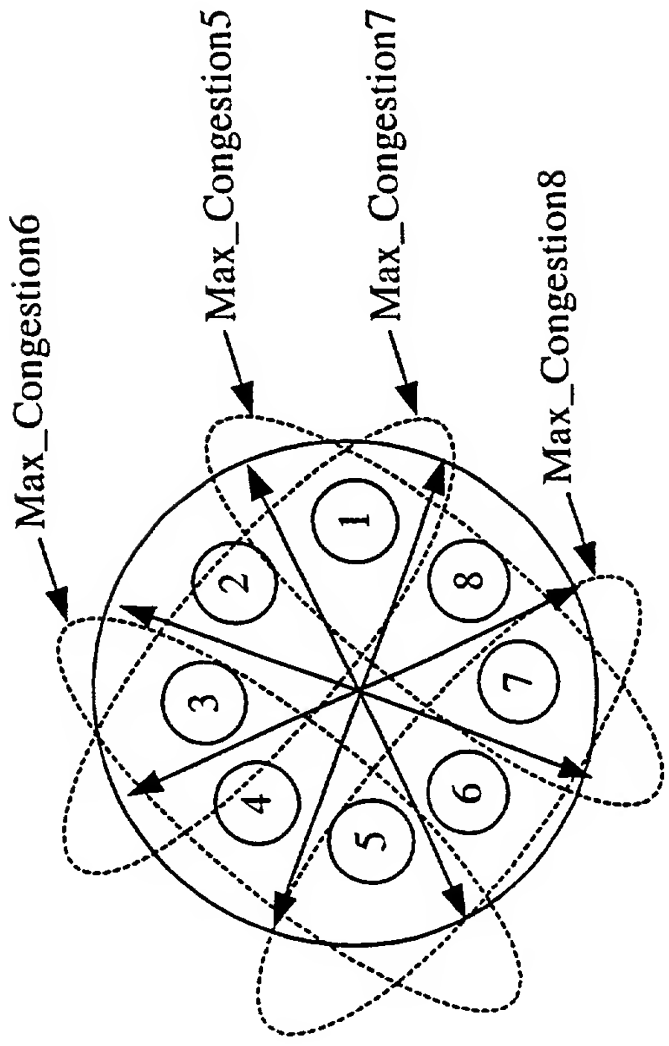


Figure 45

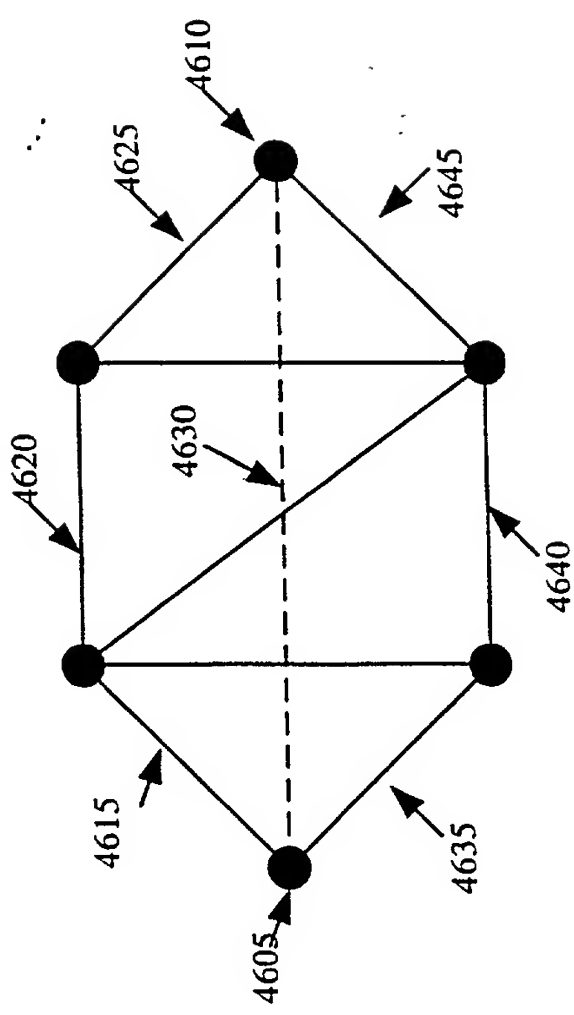
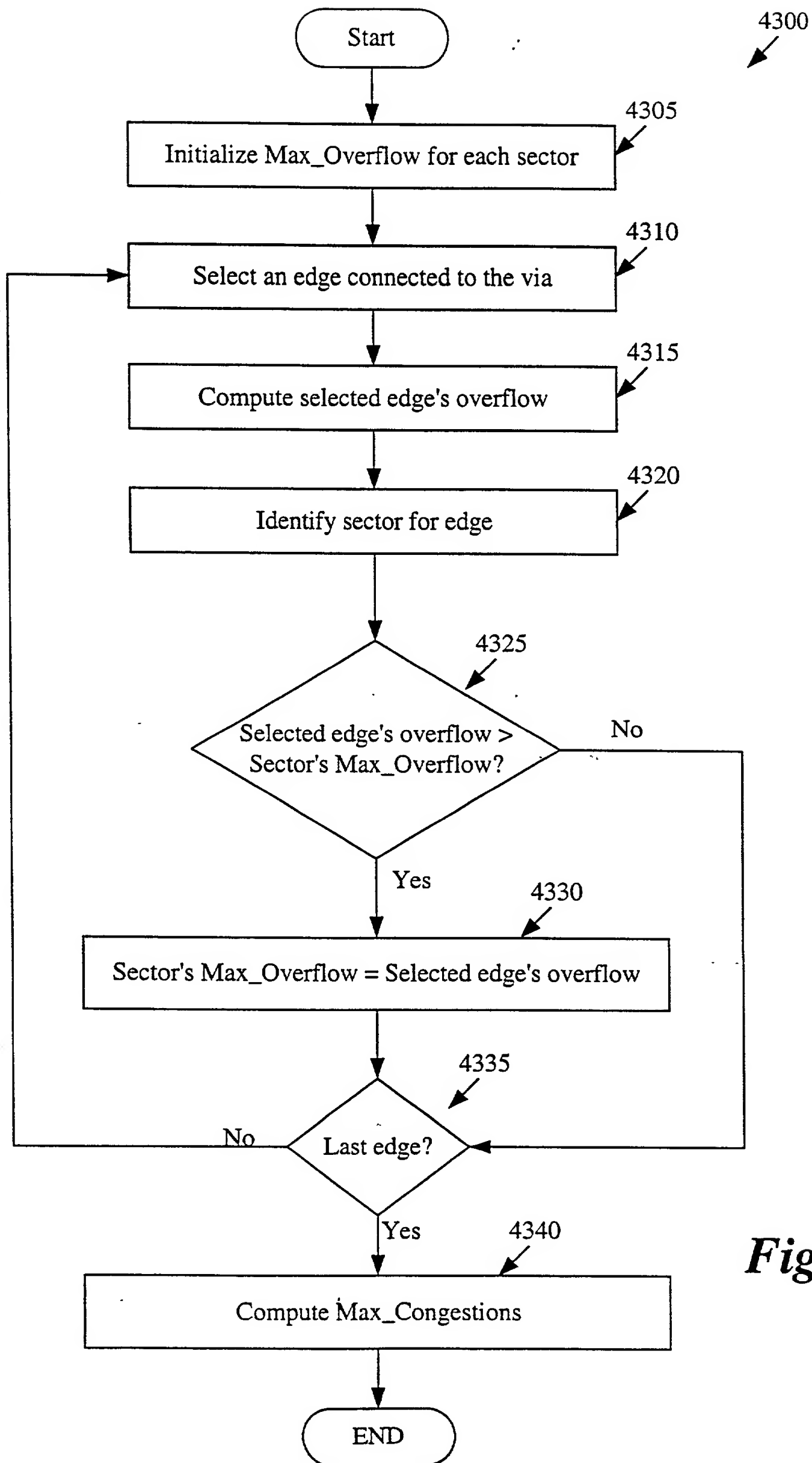


Figure 46



**Figure 43**

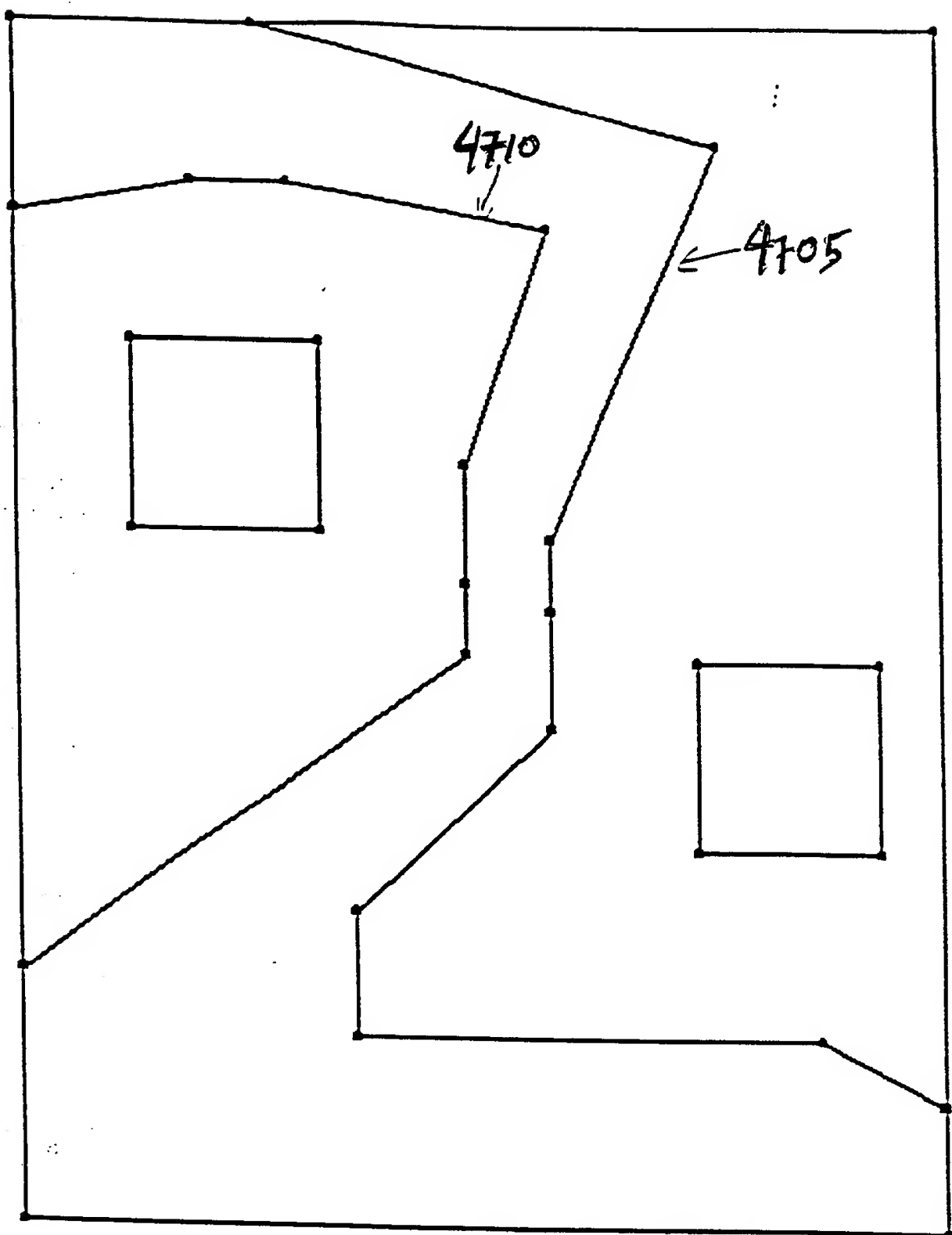


FIGURE 47

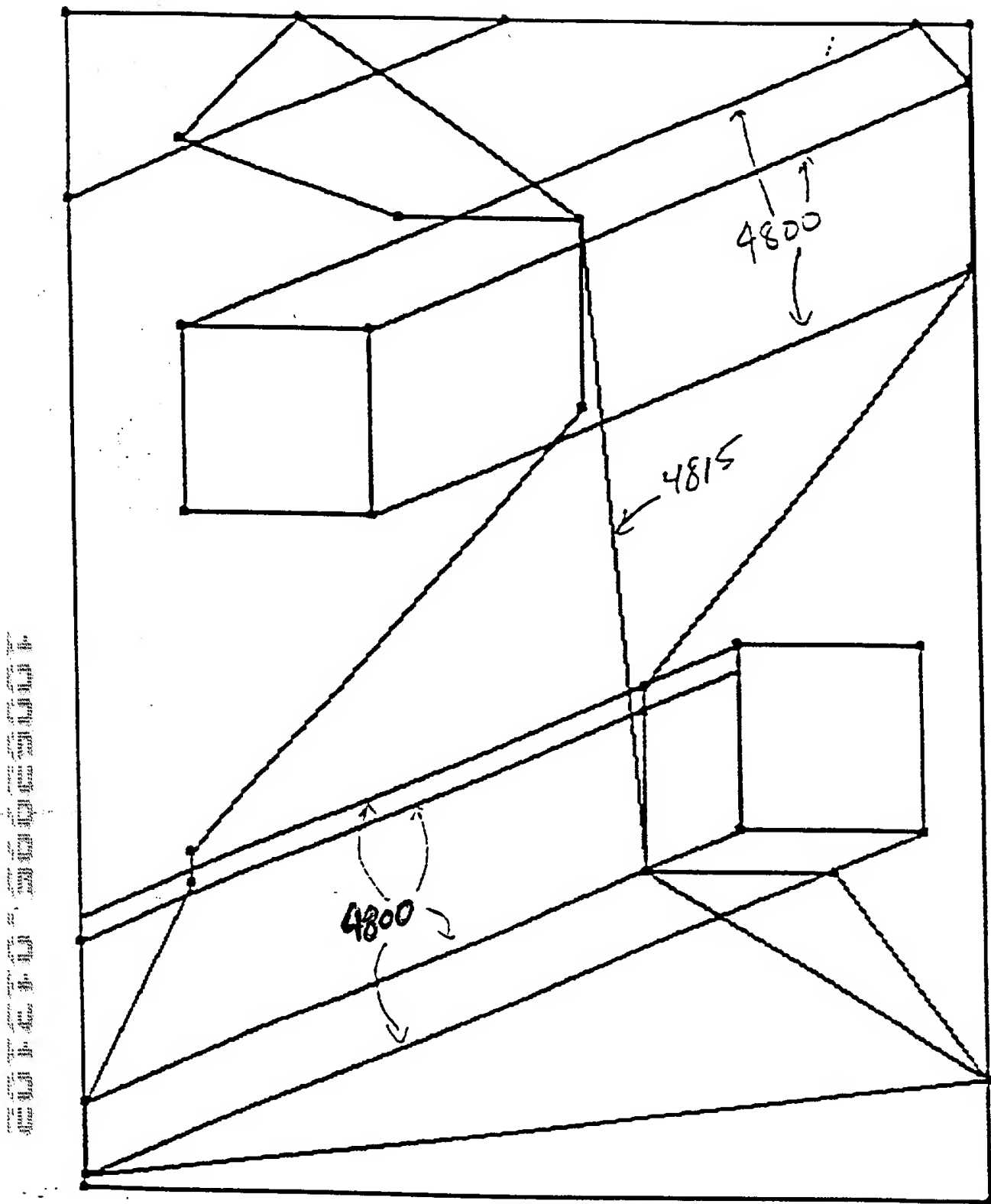


FIGURE 48A





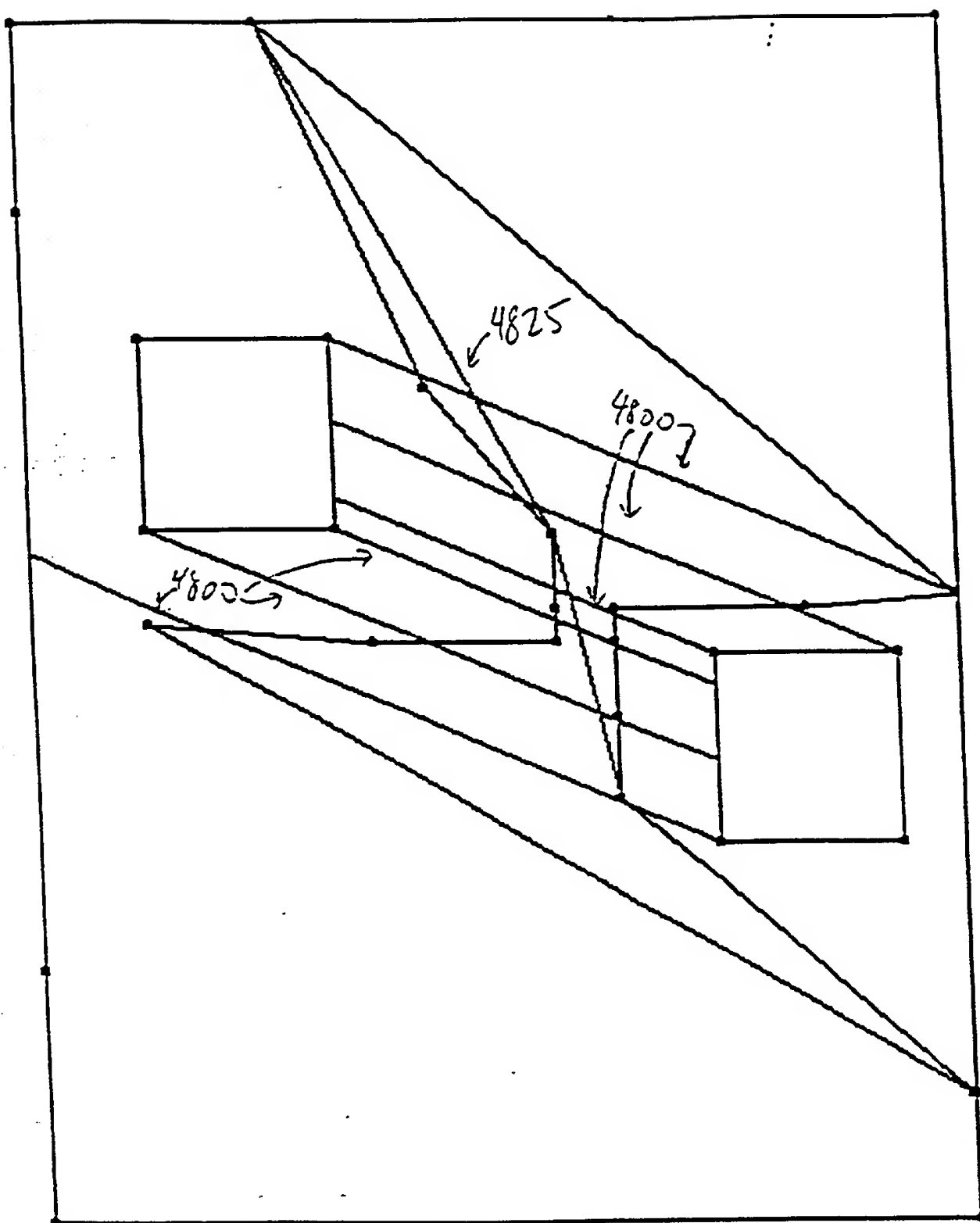


FIGURE 48C

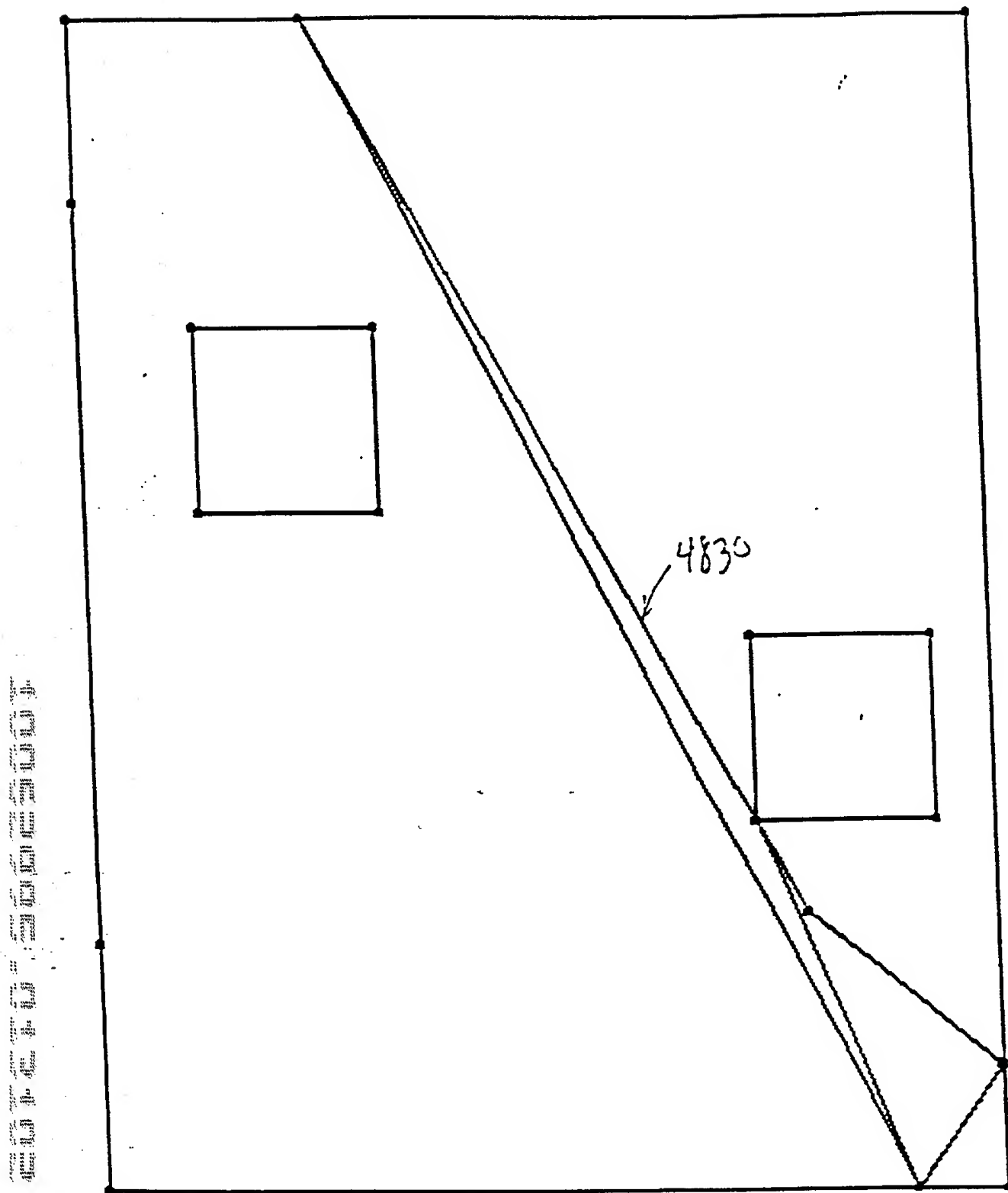
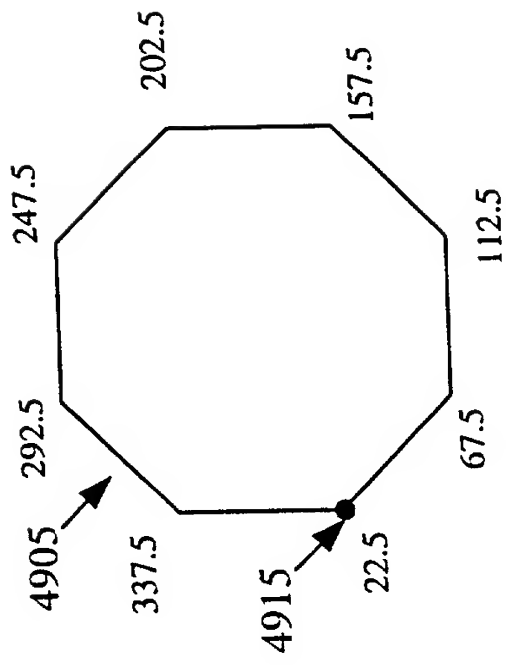
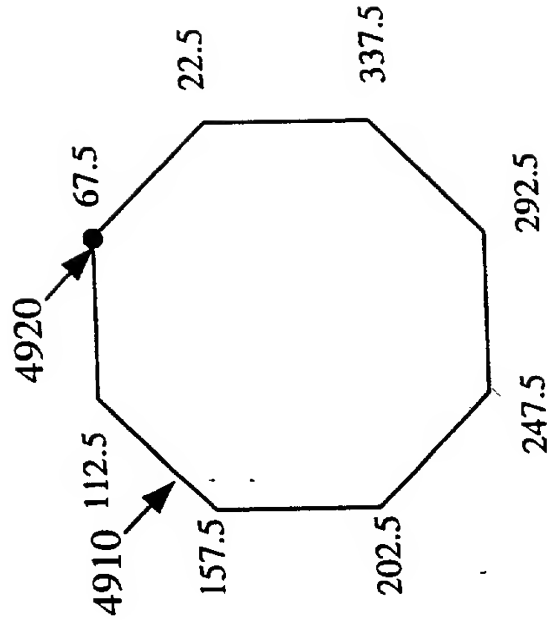


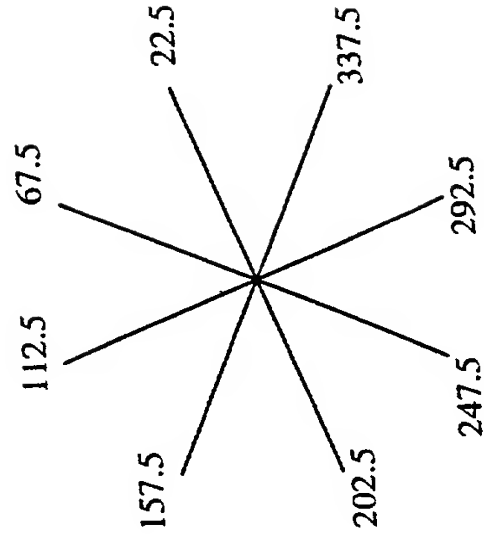
FIGURE 48D



**Figure 49A**



**Figure 49B**



**Figure 49C**

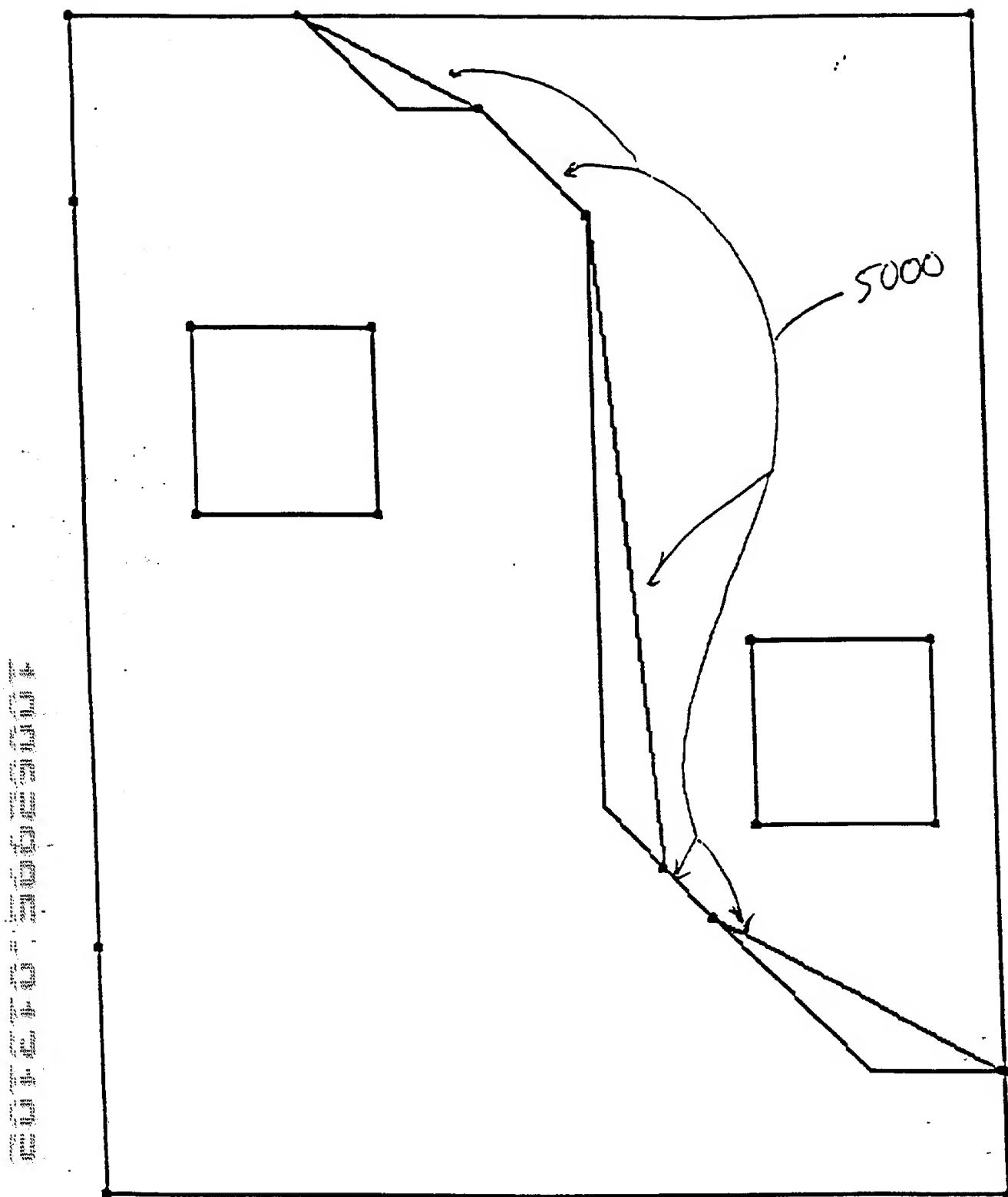
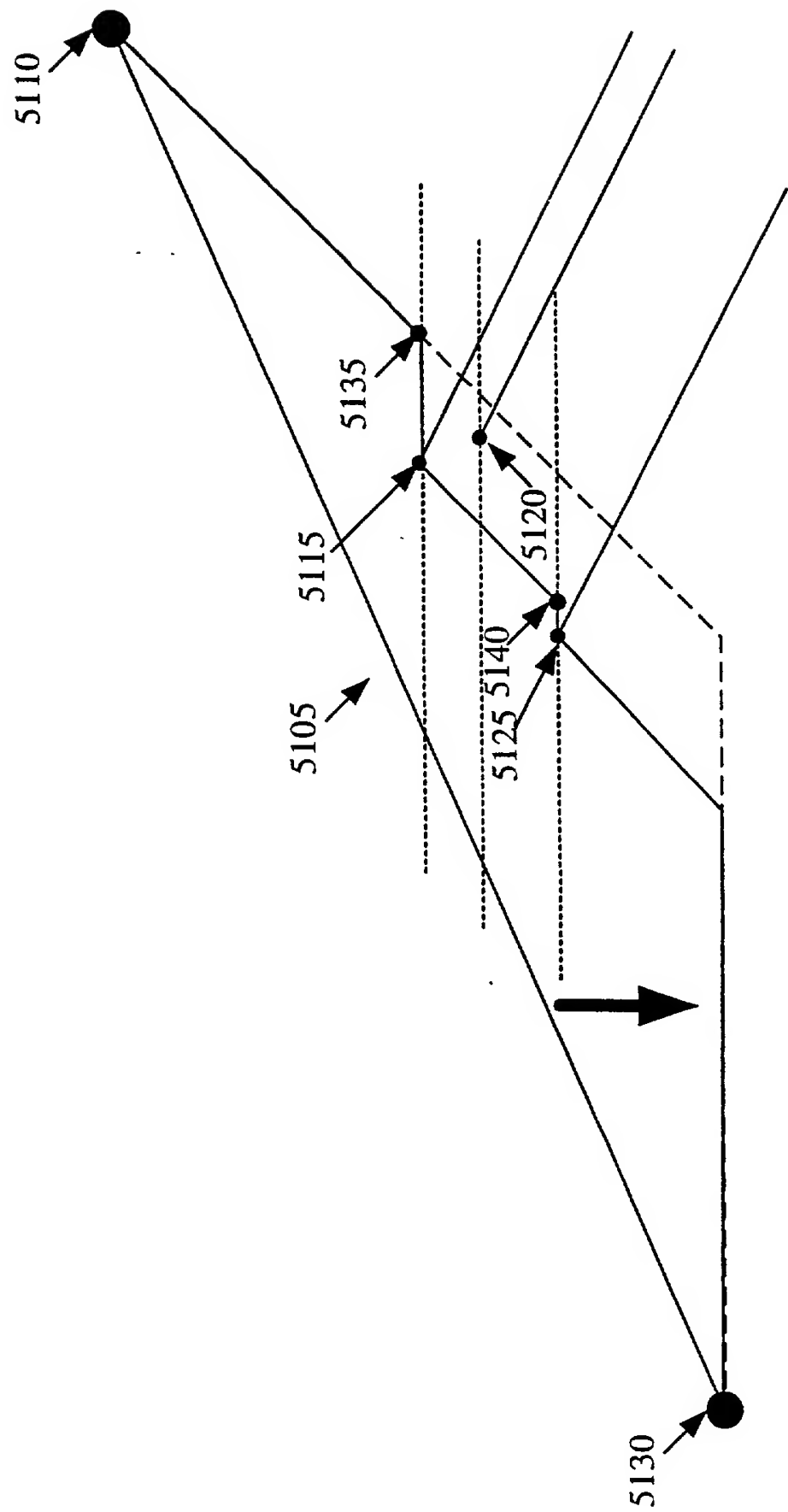


FIGURE 50



*Figure 51*

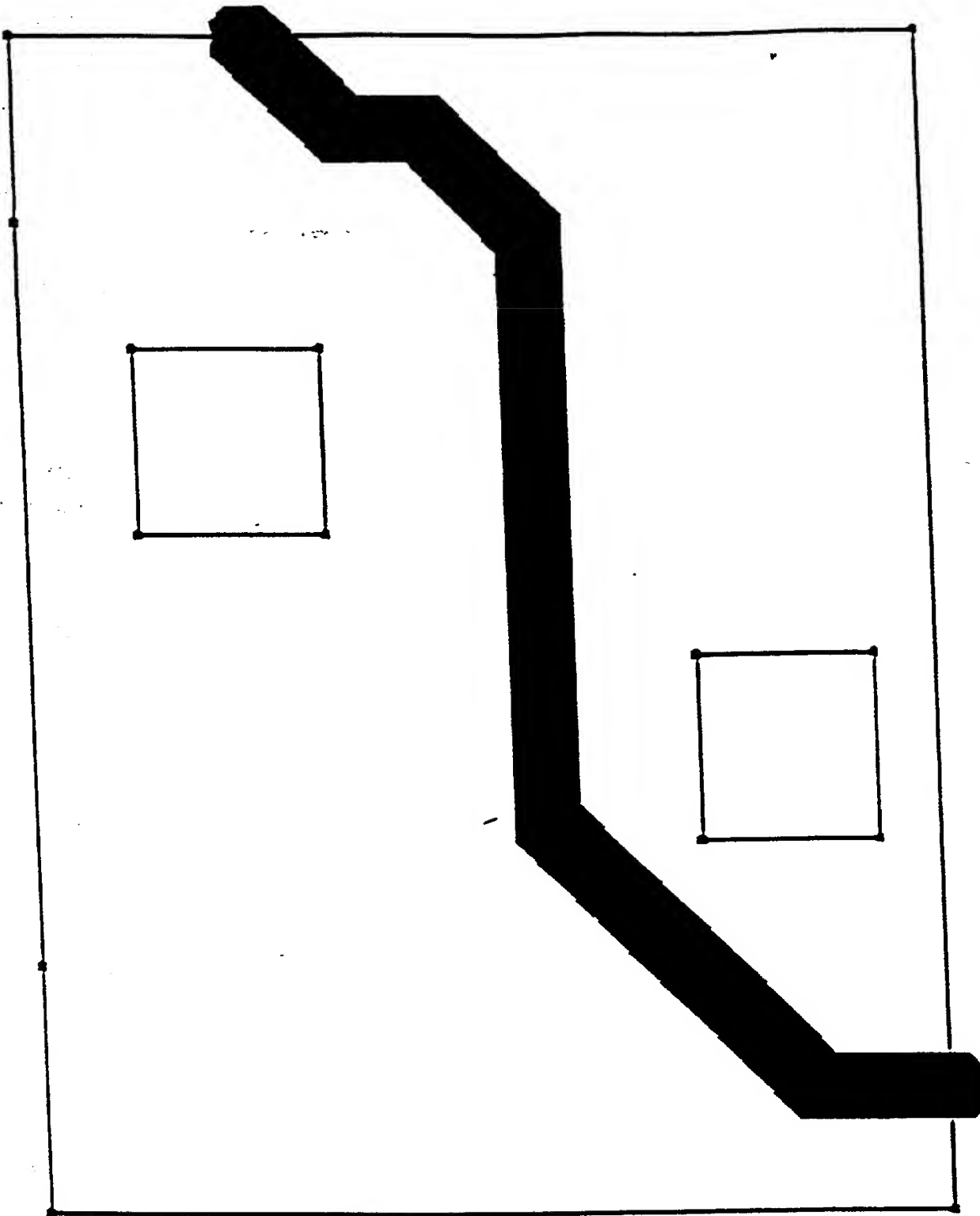
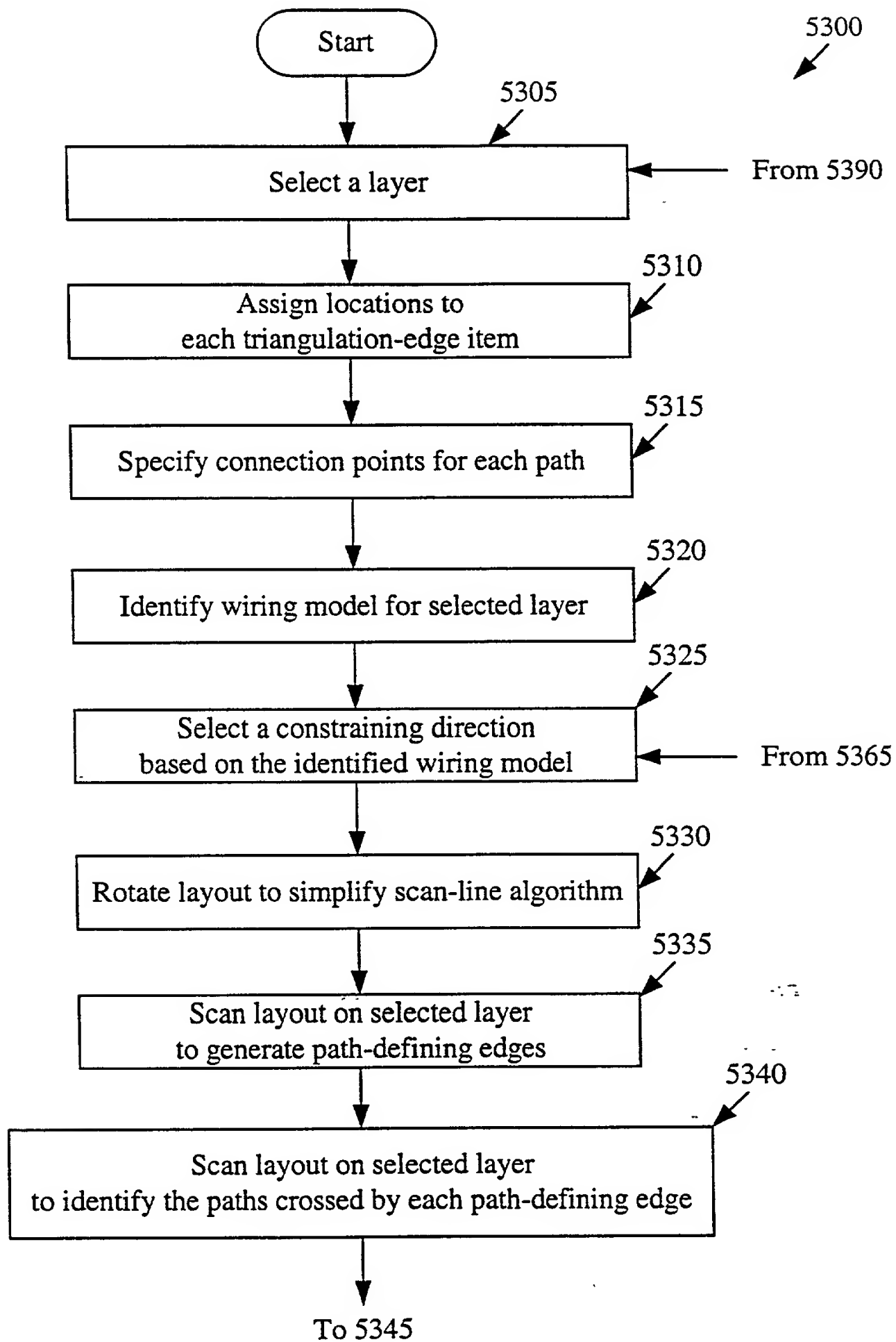
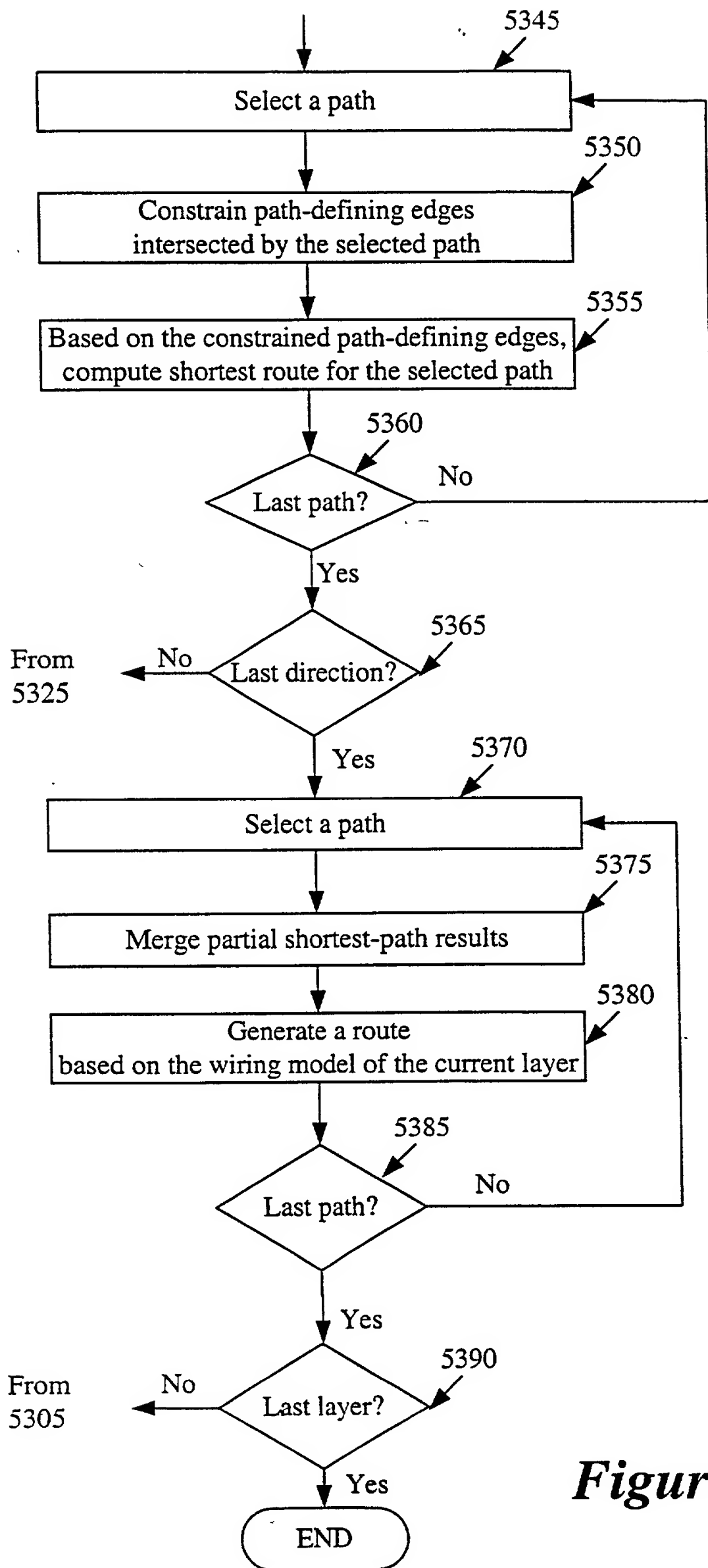


FIGURE 52



**Figure 53**

**Figure 53:** Figure 53A  
Figure 53B



**Figure 53B**



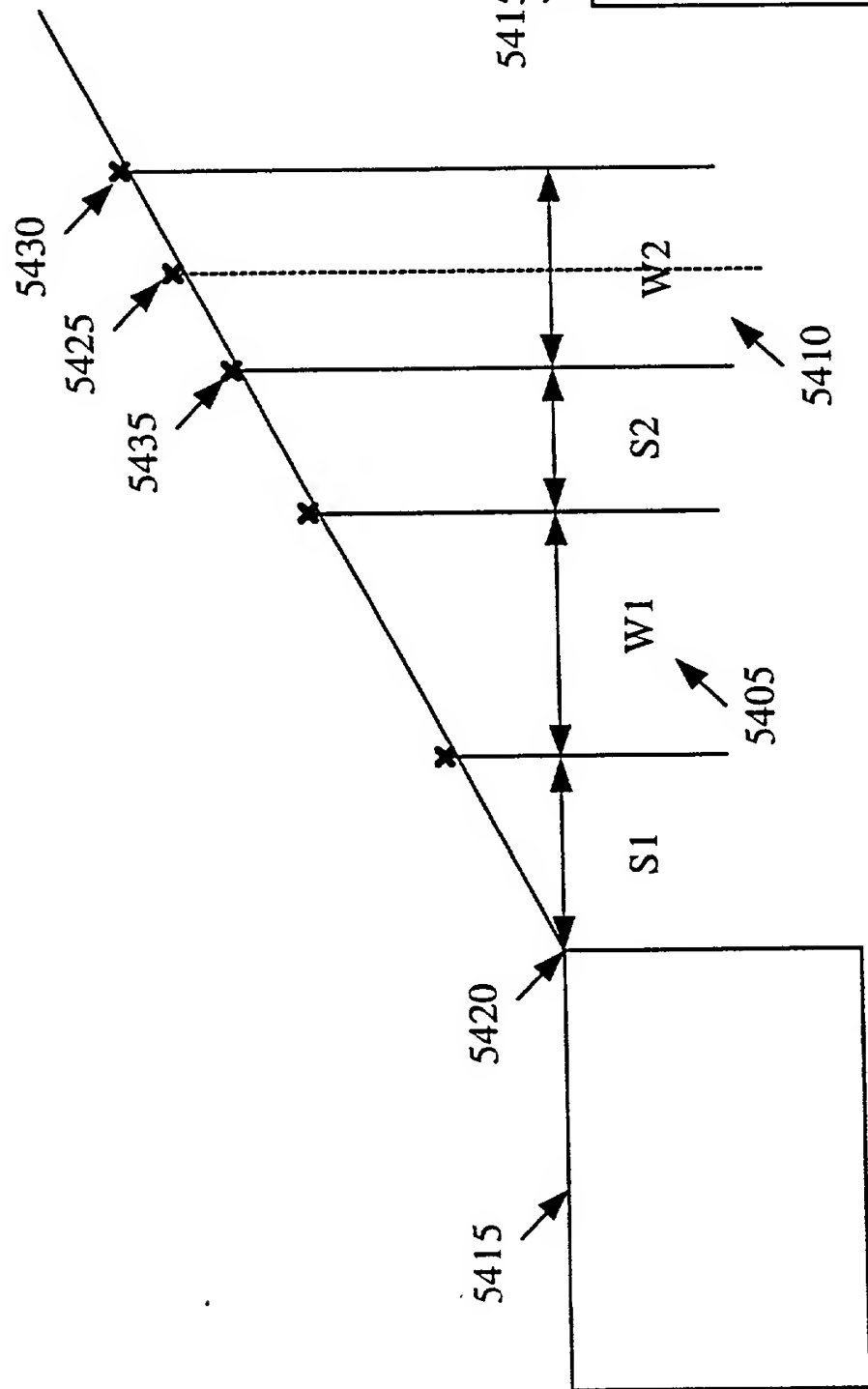


Figure 54

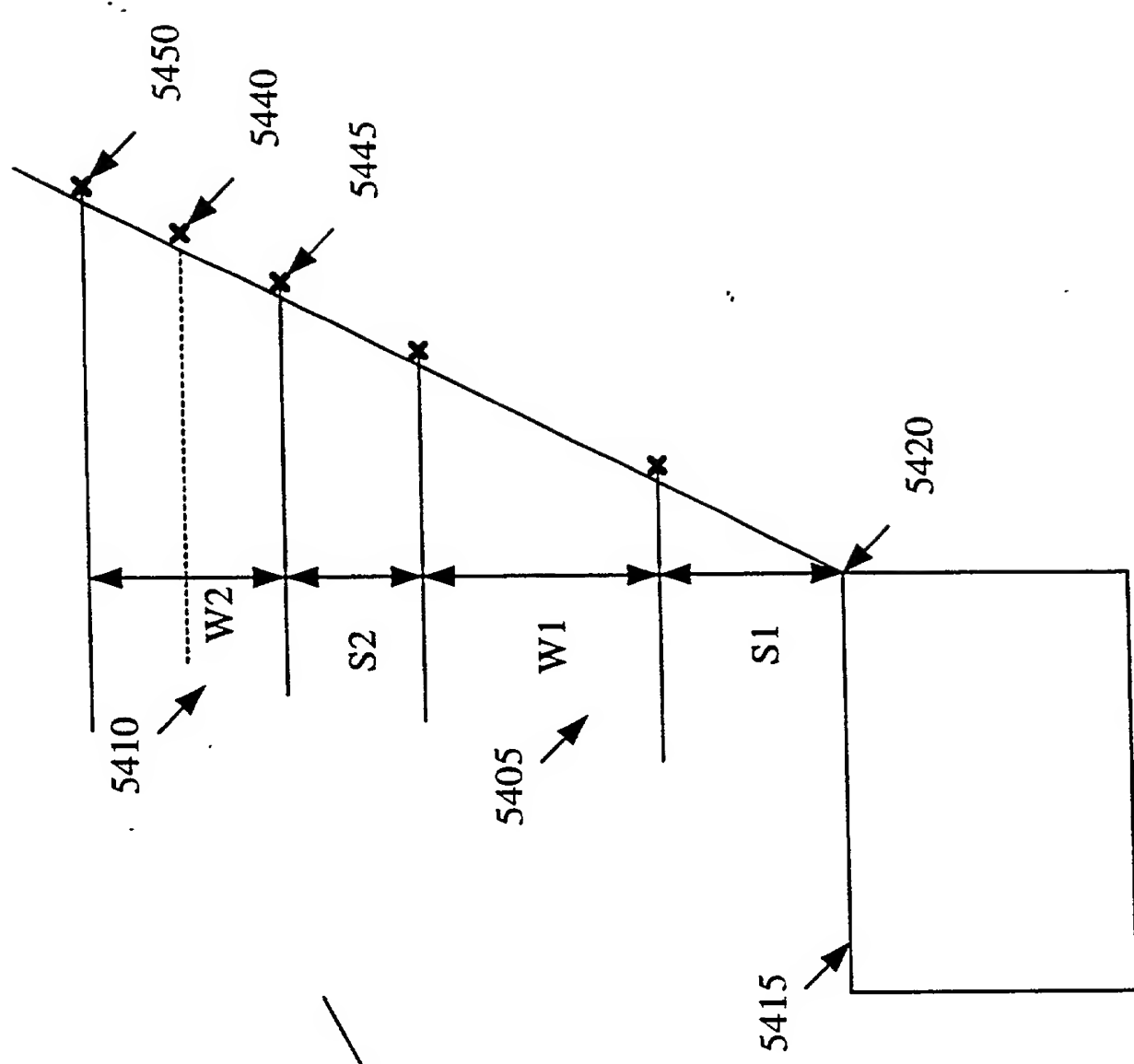


Figure 55

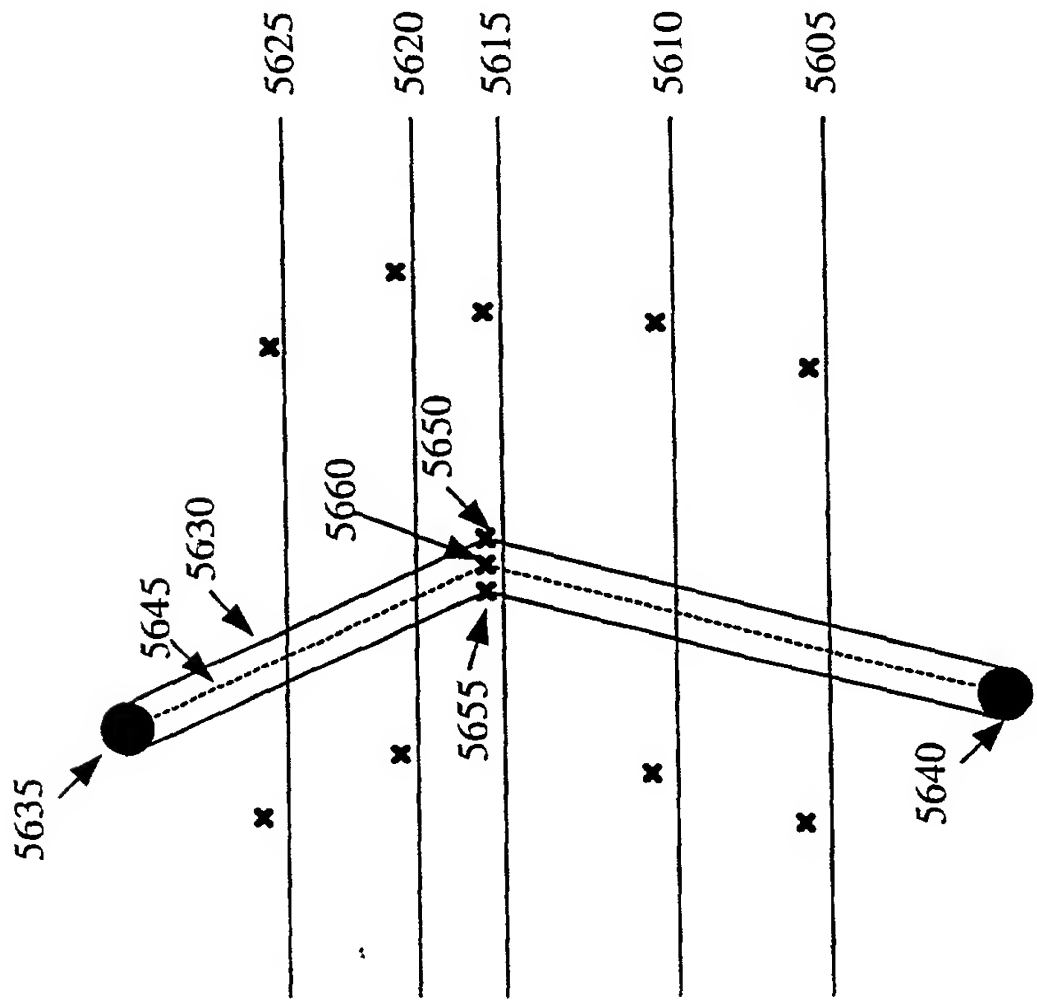


Figure 56

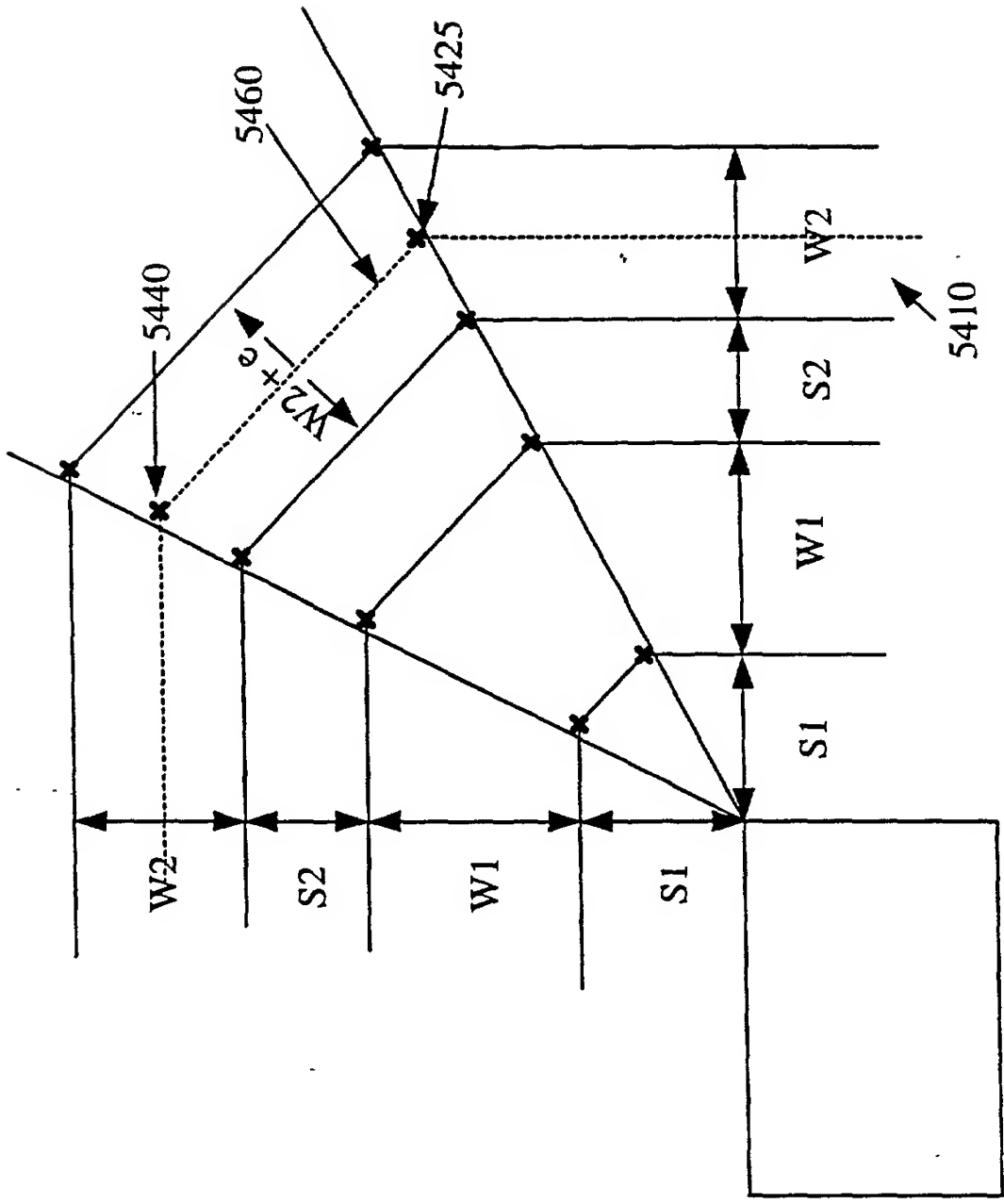
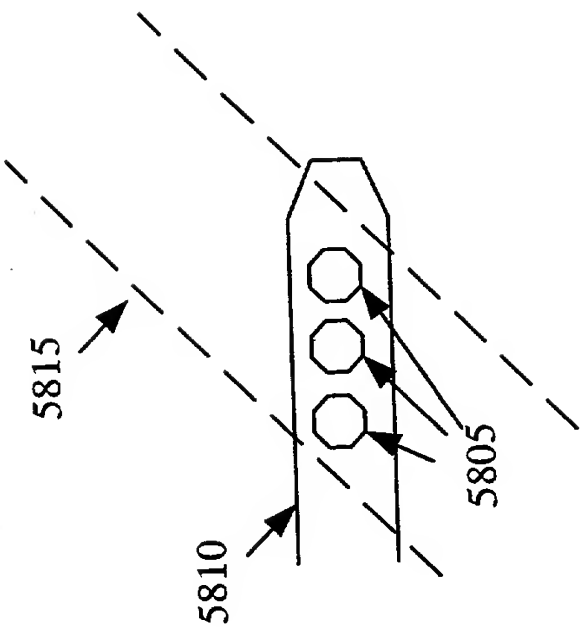
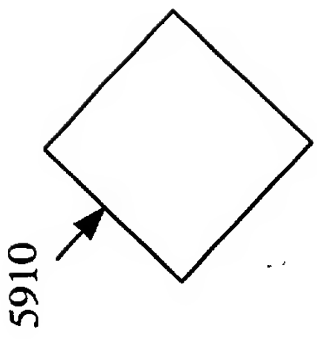
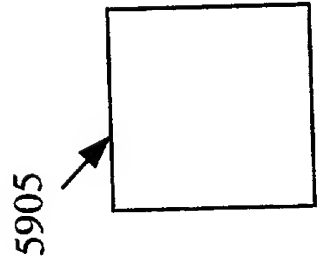


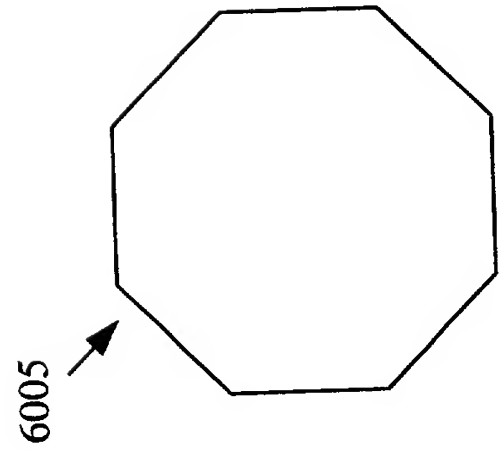
Figure 57



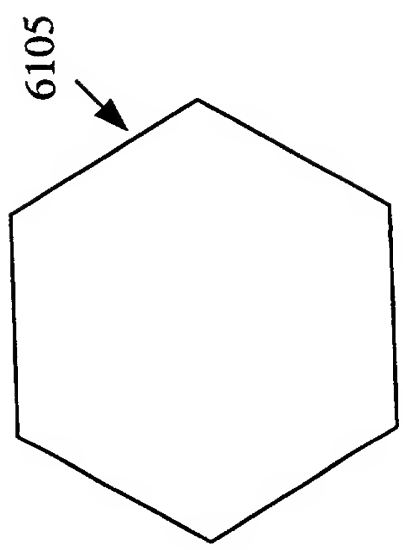
*Figure 58*



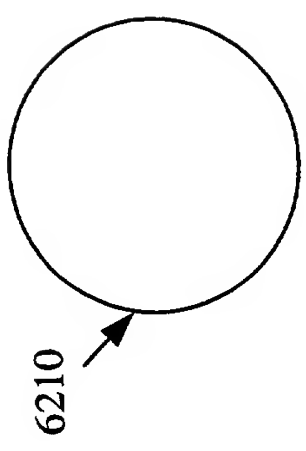
*Figure 59*



*Figure 60*



*Figure 61*



*Figure 62*

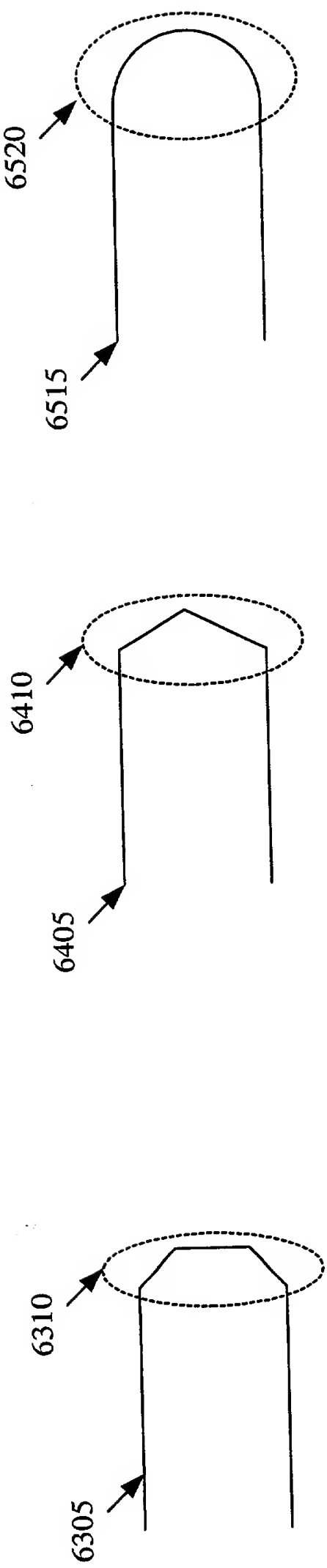


Figure 63

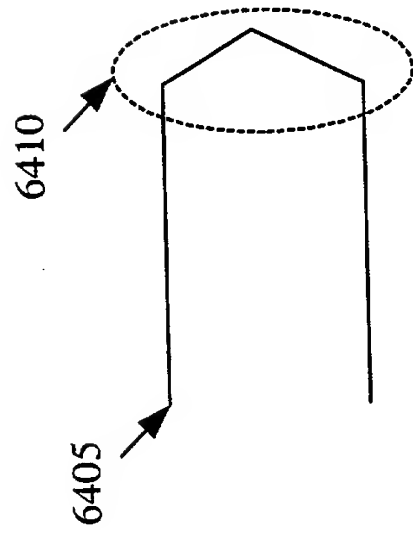


Figure 64

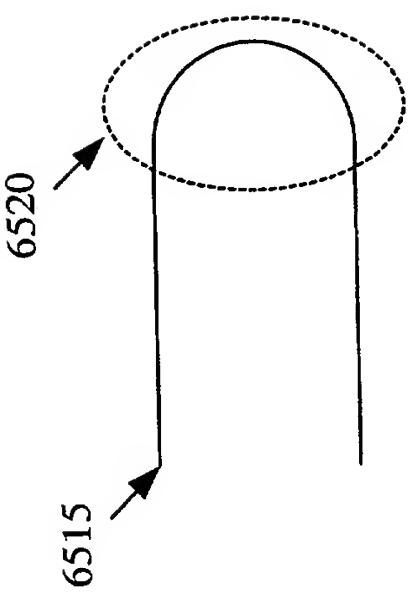
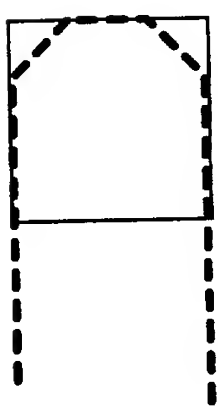
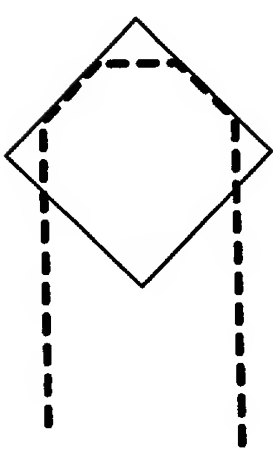


Figure 65

(1)



(2)



(3)

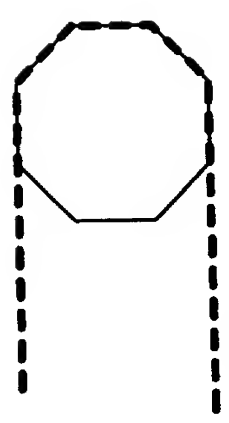
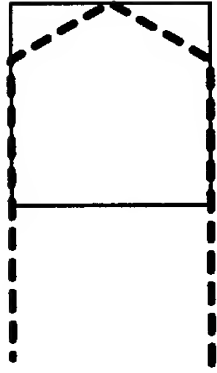


Figure 66

(1)



(2)

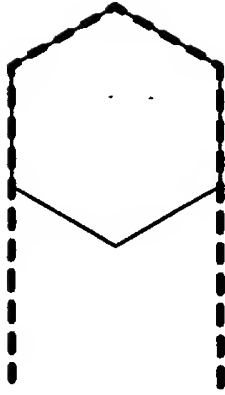


Figure 67

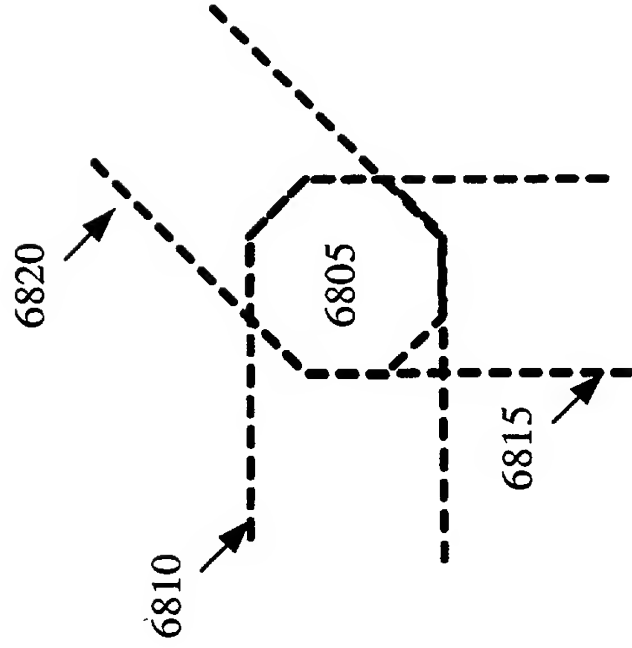


Figure 68

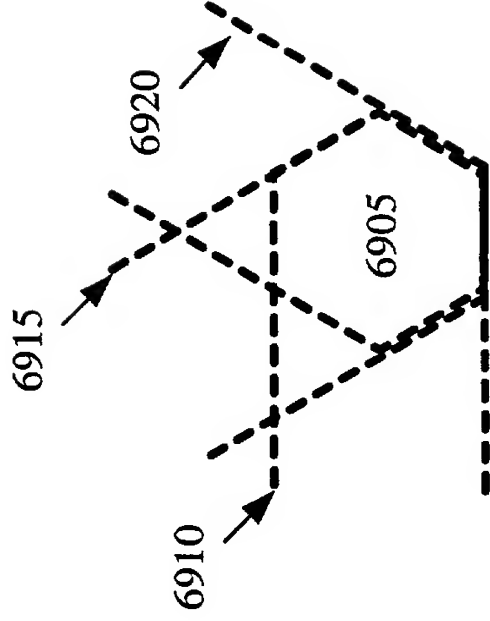


Figure 69

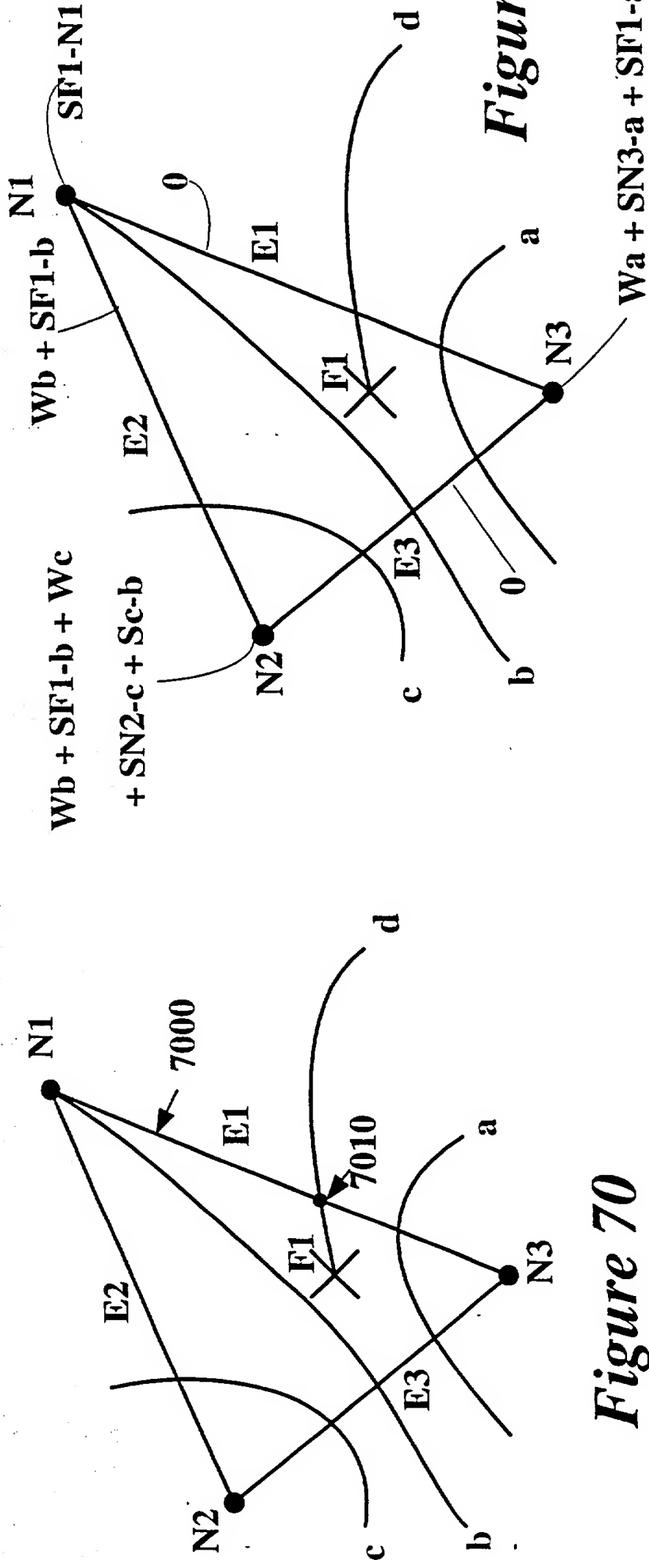


Figure 70

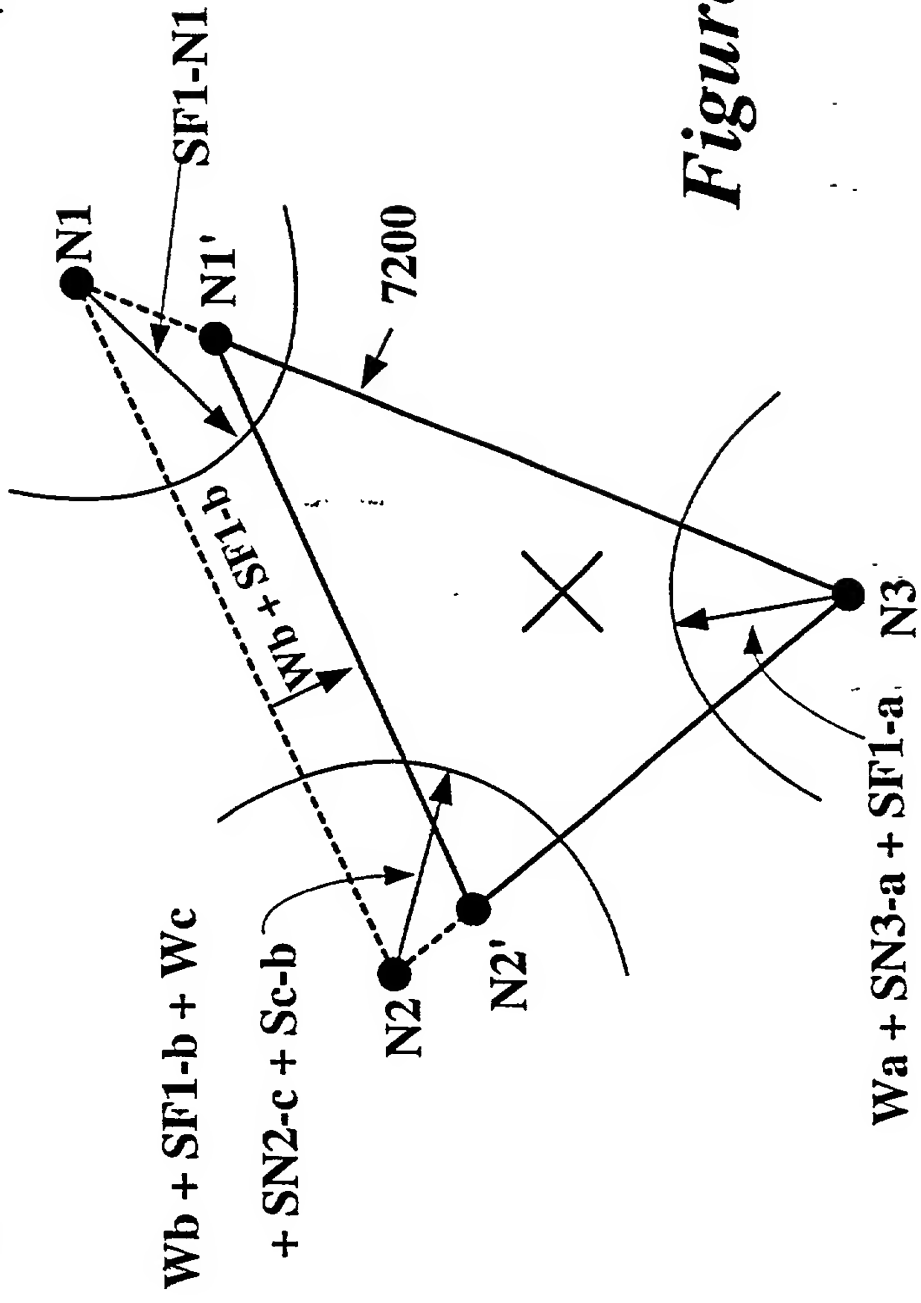


Figure 71

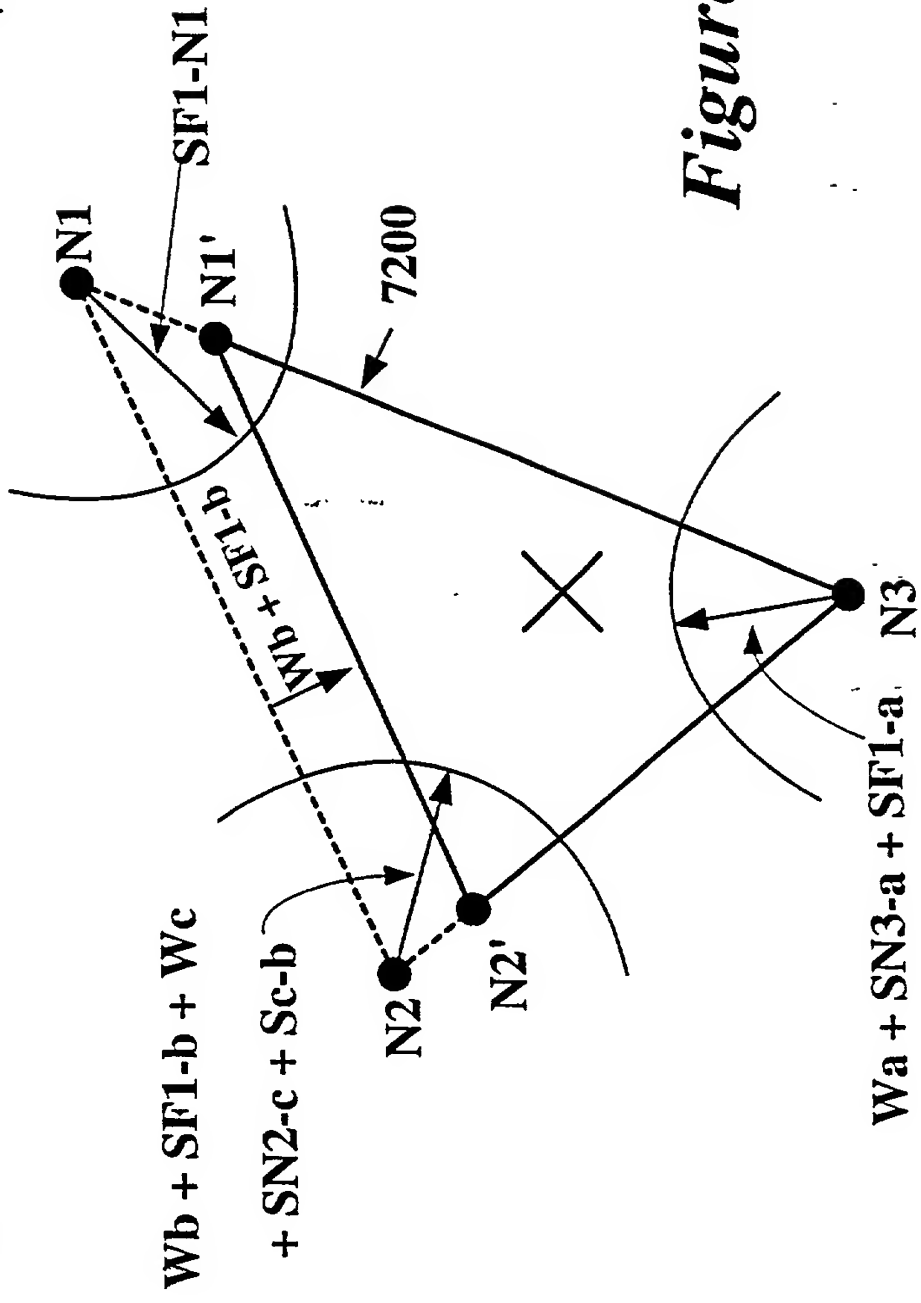
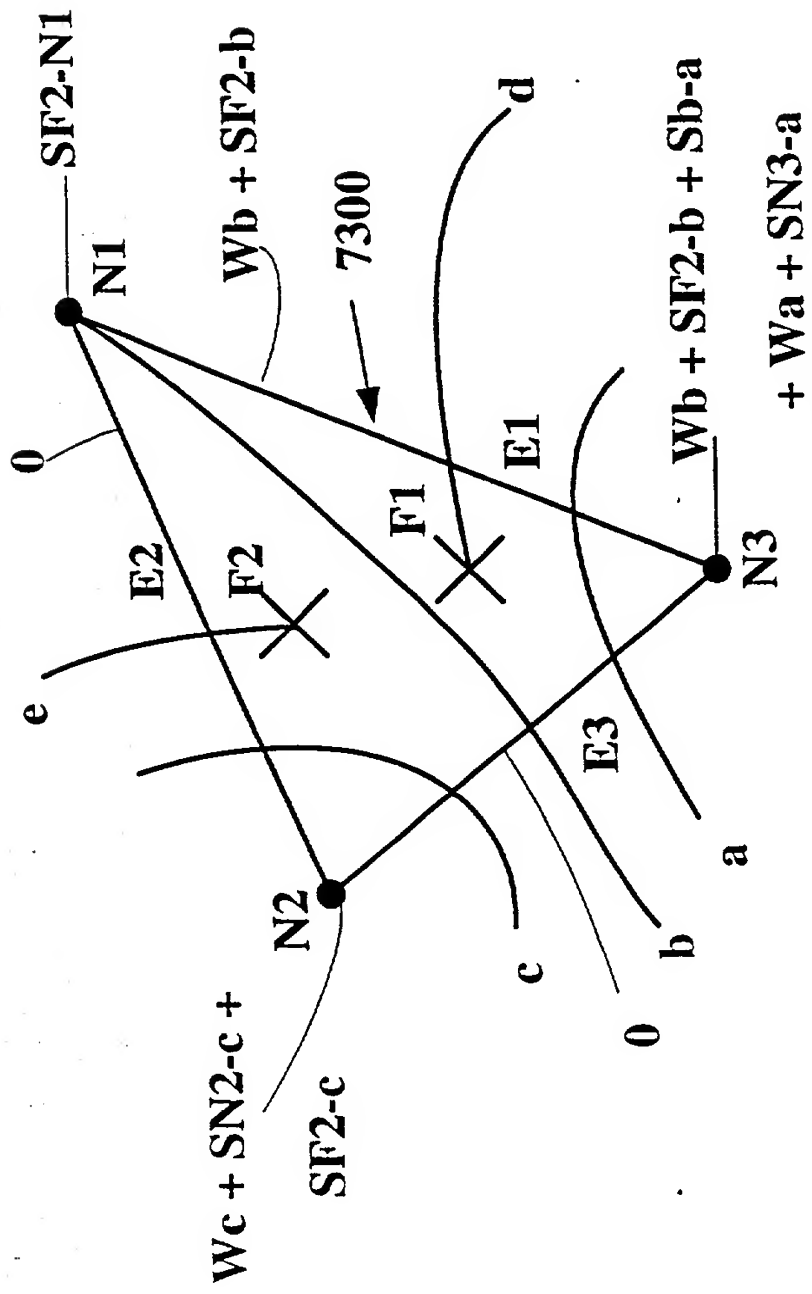
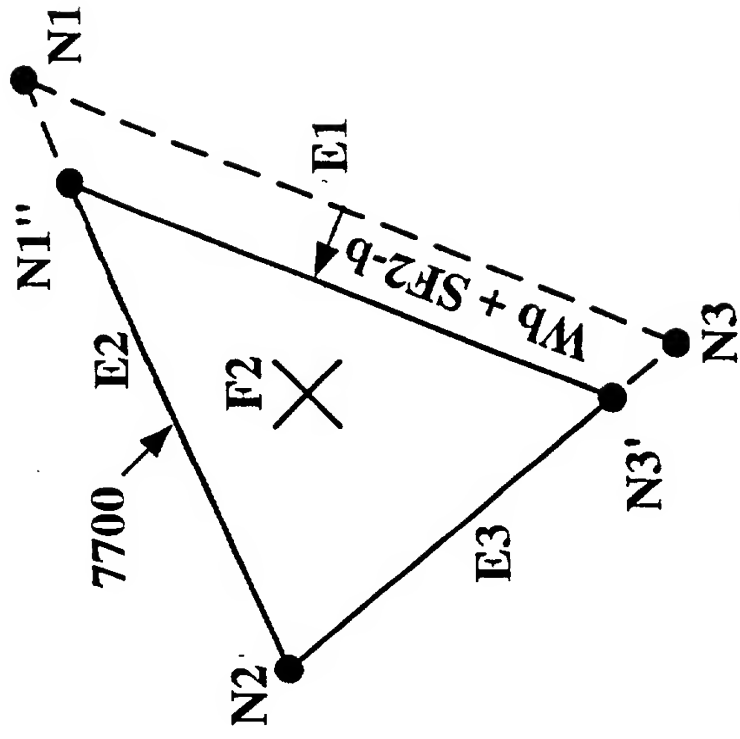


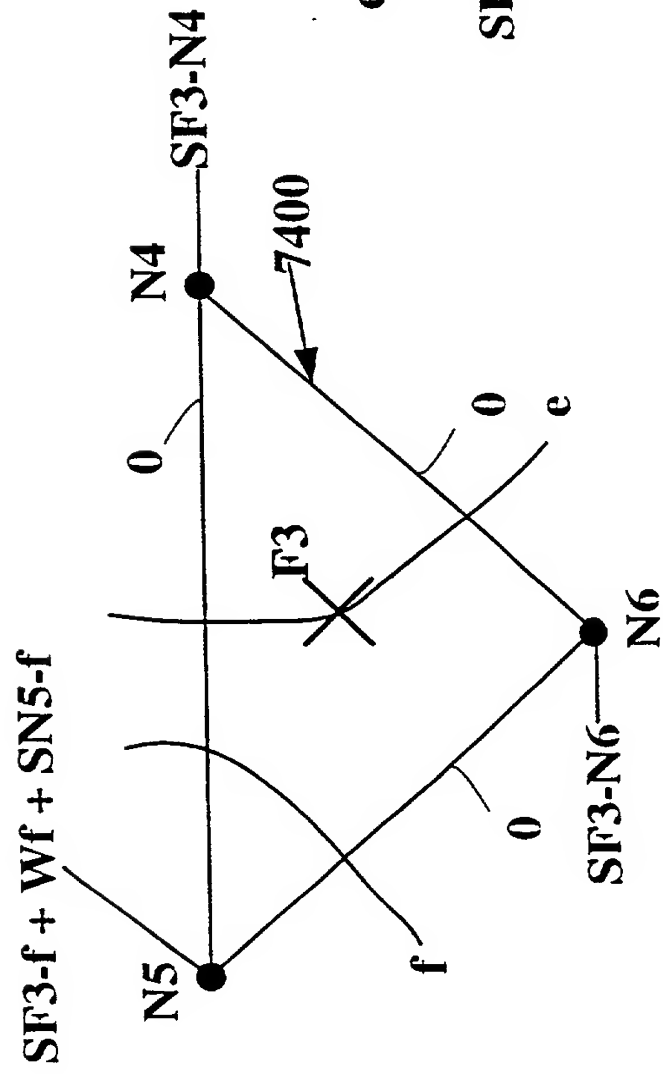
Figure 72



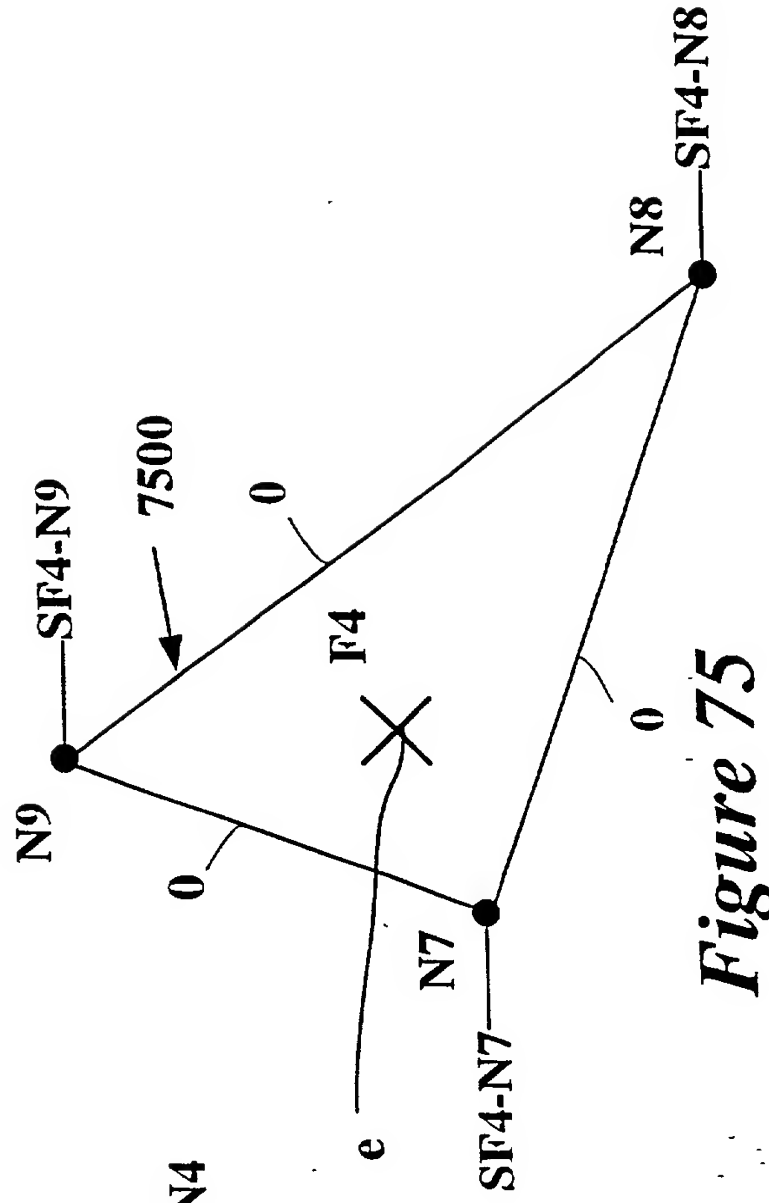
## Figure 73



## Figure 77



## Figure 74



# Figure 75



**Figure 78**







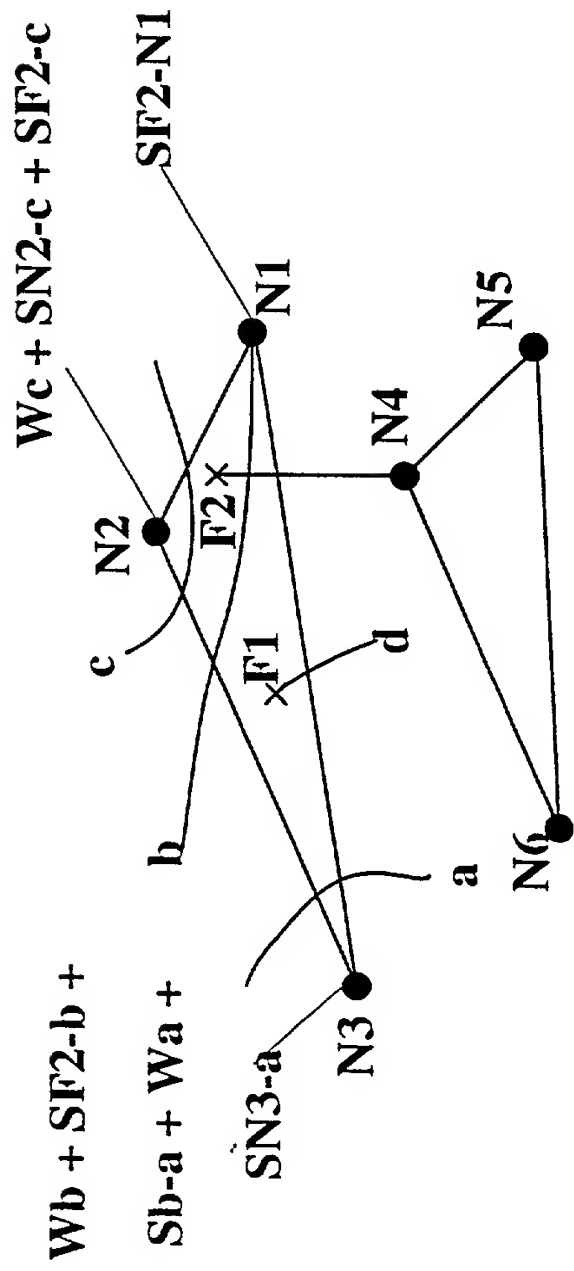


Figure 81

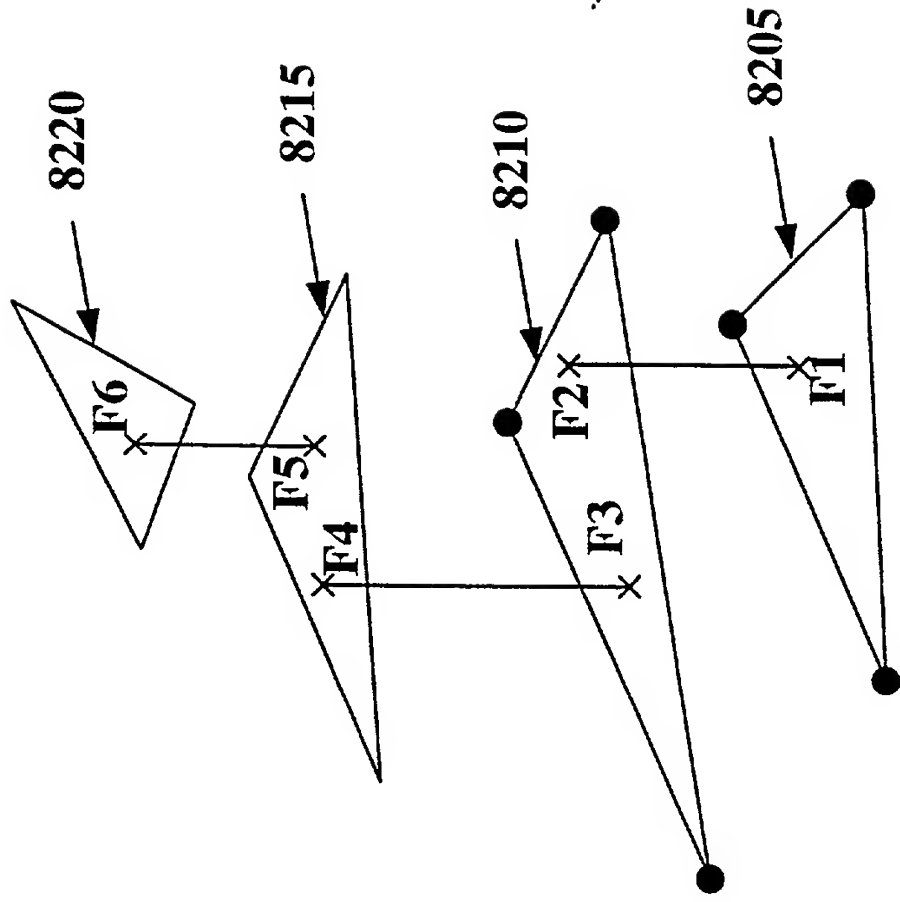
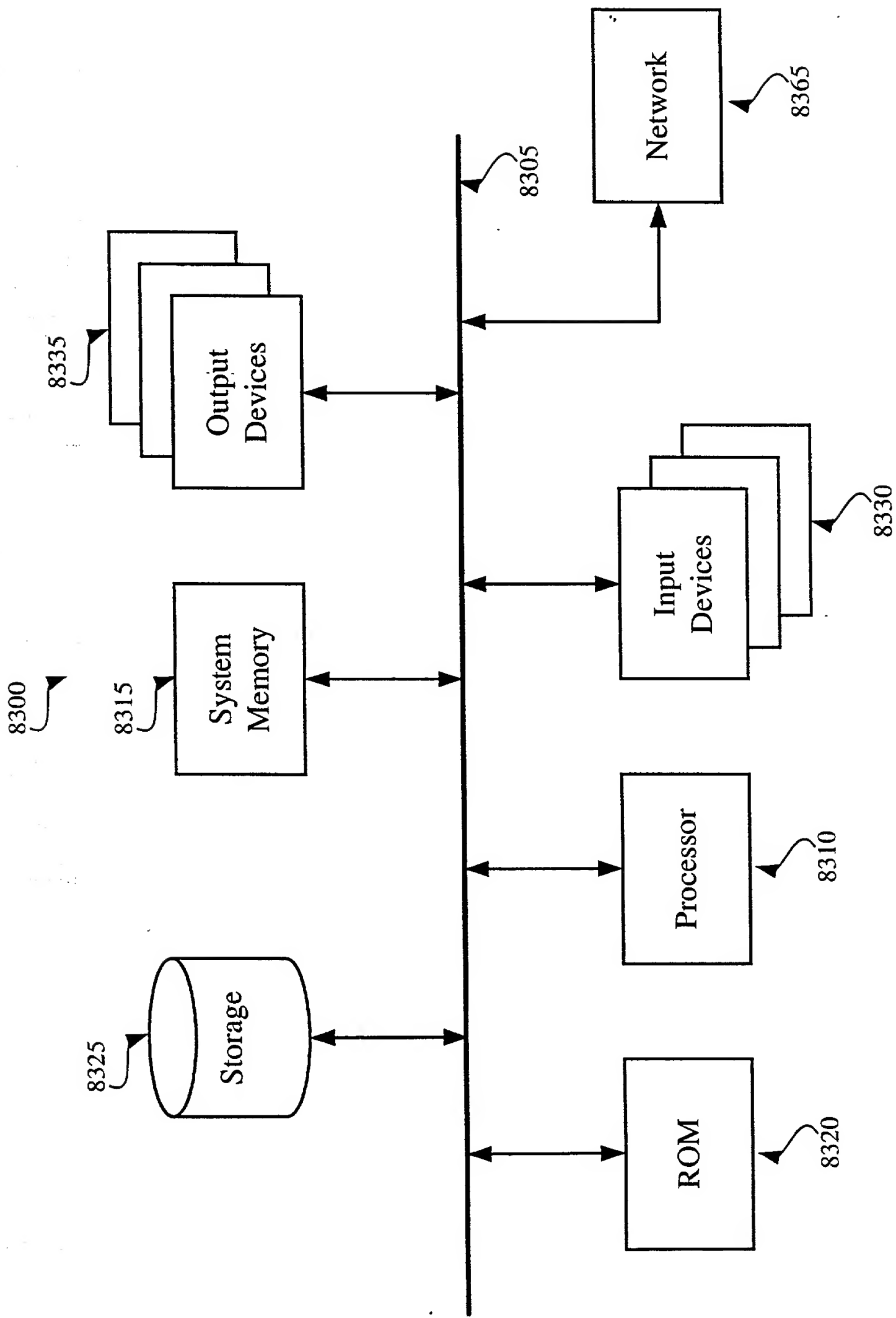


Figure 82



*Figure 83*